Evaluating the Success of the Mersey Basin Campaign and its Impact on Toxteth

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Contents

List of Figures

List of Tables

List of Abbreviations

EA:	Environment Agency
ECoC:	European Capital of Culture
GQA:	General Quality Assessment
LCC:	Liverpool City Council
LSOA:	Lower Layer Super Output Areas
MBC:	Mersey Basin Campaign
OECD:	Organisation for Economic Cooperation and Development
ONS:	Office for National Statistics
SAC:	Special Area of Conservation
SPA:	Special Protection Area
SSSI:	Site of Special Scientific Interest
WFD:	[European Union] Water Framework Directive
UK:	United Kingdom

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I would like to start my acknowledging my family's emotional and financial support throughout this project. I could not have completed this project without their help

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Declaration

I certify that this dissertation consists of my own original work. All quotations from published and unpublished sources are acknowledged as such in the text. Material derived from additional sources is also indicated.

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Abstract

The Mersey Basin Campaign was established in 1985 to improve water quality within the Mersey Catchment at a cost of £2.5bn, and invest £1.5bn in regeneration. This thesis assesses how successful the MBC has been in improving water quality across the Mersey Catchment as well as regenerating one of Liverpool's most deprived areas, Toxteth. There is little literature which has reviewed the Mersey Basin Campaign since its termination in 2010; this thesis aims to update the literature. To evaluate water quality, data was obtained from 30 field sites within an Environment Agency data set spanning ten years. Water quality was assessed on water chemistry, biology, nitrates and phosphates content. The Environment Agency used a grading system whereby 1 is a "very good" river with a high population of species, and 6 describes a "bad" river which only supports limited pollution-tolerant macroinvertebrates. The average Chemistry grade improved from 3.3 in 1999 to 2.73 in 2009. Average biological ranking improved from 4.24 in 2002 to 3.87 in 2009. Average nitrates ranking improved from 3.43 in 2000 to 3.3 in 2009, and phosphates improved from 4.93 in 2000 to 4.37 in 2009. Average statistics across 30 field sites improved from 1999-2009 but not to MBC aims of achieving 'good' or higher status. To assess improvements in deprived inner city areas, Liverpool City Council gathered data for each ward across Merseyside in 2013 and two wards, Riverside and Princes Park were selected. The data analysed shows the poorest ward, Princes Park has an average household income 67% of the National Average, unemployment 150% higher than the National Average and deprivation of 93.7%. As a result Toxteth has high percentages of child poverty. The MBC has improved water quality across the 30 field sites but not to a "fair" standard, nor has regeneration undertaken by the MBC sufficiently improved Toxteth.

1. Introduction

Water is vital for survival, yet many people in the developed world take it for granted (Bitelli *et al.*, 2011); "Whether for sustenance, sanitation, fire-fighting or industrial use, water was the original public utility and historically the first urban problem" (Hassan, 1985; Lampard, 1973). The decline in UK river water quality is due to industrialisation, population increase, forest harvesting, riparian grazing and channelization. The cultivation of farmland resulted in extensive straightening of streams and rivers as well as drainage of riparian wetlands (Friberg *et al.*, 1998). Pre-industrialisation, slaughterhouses, tanneries and bleach works were the main contributors to river pollution (Hassan, 1985). Post-industrialisation, most of the increase in the water industry's capacity in the north of England was devoted to fulfilling industry requirements, leading to water quality decline which compromised biodiversity and increased the spread of water-borne diseases such as cholera (Hassan, 1985: Eyler, 2001).

Shafik (1994) describes the relationship between economic growth and environmental quality as controversial where two extremes are given: one is that greater economic activity leads to further environmental degradation, and the second is that environmental problems worth solving will be addressed automatically as a consequence of economic growth. The Mersey Estuary has suffered a legacy of abuse and neglect since the beginning of the Industrial Revolution as a result of economic growth: the discharge of effluents from manufacturing processes, together with wastewater from population centres resulted in the Mersey being one of the most polluted rivers in Europe (Jones, 2000). The Mersey began to lose its prized fish stocks such as salmon which can only survive in rivers with good water quality (Craig & Morton, 1976: Langston, 1986). It is only within the last thirty years that significant efforts to improve the Mersey Catchment water quality have been undertaken.

1.1 The Mersey Basin Campaign

Established in 1985, the Mersey Basin Campaign (MBC) aimed to address continuing problems of water quality and associated landward dereliction of the River Mersey (Wood *et al.*, 1999), and in 2004 the project was extended to include the River Ribble and its tributaries. The Campaign was a response to Michael Heseltine's efforts to secure funding for Merseyside: by 1985 the Mersey Estuary received up to 60% of the mainland pollution caused by its 5 million residents within the Mersey catchment (Wood *et al.*, 1999). Due to the scale of the problem, the Campaign had an anticipated 25 year lifespan. Its primary aim was to "address the problem of water quality and associated dereliction on a river catchment" (Bannister *et al.*, 2005). The project required water companies, regulators, industry, local authorities and residents working together, creating a detailed corporate structure (Wood *et al.*, 1999). The MBC established a network of 20 coordinators working closely with volunteers, schools, businesses and politicians on a wide range of enhancement projects (Mersey Basin Campaign, 2015). This was a government-backed venture with leading partners United Utilities, the Environment Agency and the Northwest Development Agency (NWDA) (Mersey Basin Campaign, 2015). The costs associated with these aims were estimated to be around £4 billion, with £1.5 billion being spent on landward regeneration and £2.5 billion on water quality improvements (Wood *et al.*, 1999).

The three initial aims of the MBC were to improve river quality to at least "fair" standard by the year 2010 so that all rivers and streams are clean enough to support fish; to stimulate the development of attractive waterside environments for businesses, housing, tourism, heritage, recreation and wildlife, and to encourage people living and working in the Mersey Basin to value and cherish their watercourses and waterfront environments (Wood *et al.*, 1997). The importance of investment to stimulate attractive waterside locations for economic gain was particularly important for Merseyside. A sharp decrease in population and a long-term increase in unemployment resulted in groups and individuals were left with a welfare state that was struggling to cope in terms of education, income support and housing (Meegan, 2003).

1.2 Merseyside's Crisis of Decline

Due to rapid deindustrialisation and mass unemployment from the 1950s onwards, tensions in the most deprived areas of the UK began to rise. In the 1980s, Margaret Thatcher's economic policies saw Britain's inner-cities bearing the brunt of recession. This resulted in rioting in the late 1970s and early 1980s in many inner city areas and working class housing estates where unemployment was rife (Waddington and King, 2009). The 1980s and 1990s saw repeat disturbances in many towns and cities and the most significant riots were in London, Manchester and Liverpool in 1981. Riots in the Merseyside area were the most extreme, particularly in Toxteth.

Located in South Liverpool in the North West of England, Toxteth is often remembered across the UK due to the 1981 riots which made the national news, and the area has struggle to remove its damaging reputation since (The Guardian, 2011). The 1981 riots occurred as a result of long-standing tensions between police and the community and were eventually triggered by the police pursuing a man who was wrongfully accused of stealing a motorcycle. A second man, Leroy Cooper, a photography student who had been at a youth club, intervened and was in turn arrested for assault (The Guardian, 2011). Nine days of rioting saw 470 police officers injured in addition to members of the public, 500 people arrested, one man killed, 100 cars burned, 70 buildings destroyed and an estimated damage value of £11m (The Guardian, 2011; Liverpool Echo, 2011).

Many British cities were experiencing industrial decline from the early 1960s, particularly in their inner city areas (Keeble, 1978). Riots occurred across other towns and cities across the UK in the late 1970s and early 1980s and politicians were first to be criticised; the riots were described as predictable. At the time, unemployment in Britain was at its highest for almost 50 years, industrial decline had been accelerating for the past 20 years (Keeble, 1978) and Toxteth's male unemployment rate was at 31% (Cooper, 1985). The Merseyside region suffered from two factors detrimental to inner city areas: poor water quality and deindustrialisation. The Mersey Basin Campaign was instigated to address these issues.

1.3 Core Purpose and Objectives

As the Mersey Basin Campaign had two main areas of focus; improvements in water quality and regeneration; this thesis aims to examine each of these areas in order to draw conclusions as to whether the MBC has been a success, or to what degree its success has been. Therefore this thesis will examine the success of the Mersey Basin Campaign (MBC) in improving water quality across Merseyside, as well as seeing how any subsequent regeneration has affected Merseyside, focusing on Toxteth in particular.

This research starts by explaining why water quality across Merseyside declined throughout the 19th and 20th centuries and the methods used to try and improve it. Previous Acts and attempts to improve water quality across Merseyside have also been examined and how events led to the formation of the Mersey Basin Campaign (MBC). The thesis also discusses how Merseyside, in particular Toxteth, fell into decline and the human impacts caused as a result. The MBC is further evaluated as Toxteth is examined in detail using census statistics to determine whether regeneration and investment across Merseyside and Toxteth has been successful in improving one of the most historically deprived inner city areas in Liverpool.

The two primary questions this research will examine are;

> What was the state of water quality across the watercourses in the Mersey Catchment at the end of the Mersey Basin Campaign, and how has it improved over the final ten years of the Campaign?
>
> To what extent has the Mersey Basin Campaign been successful in improving Toxteth, one of the most deprived areas of Liverpool?

This thesis balances the use of academic literature with additional material to provide an in-depth assessment of the Mersey Basin Campaign. Wood & Handley's 1999 paper, as well as Wood *et al.* (1999) are two primary papers which are referenced throughout this thesis as both papers were produced in close conjunction with the MBC. This combined with Census and Environment Agency data allow for a detailed analysis of the environmental and economic impacts of the MBC in Merseyside.

2. Literature Review

“The problems being encountered in river management today are shown to be embedded in the history of water resource development” (Sheail, 1988). Britain’s polluted waterways had been a cause for concern since the 1850’s; the condition of the section of the River Thames flowing through London was once so bad that in the summer of 1858, the year became known as the 'Year of the Great Stink' (Sheail, 1988). Industry’s attitude to waste, namely using the natural environment as a bottomless sink, was an outcome of choices to exploit the massive economic potential without sufficient consideration of waste and pollution as long-term issue (Ridgway and Shimmield, 2002).

The River Mersey’s reputation was similar to that of the River Thames. Since the opening of Liverpool’s first dock in 1715, the Mersey catchment became a hotspot for industrial development, particularly for the textile industry. This led to an increase in the bleaching, dyeing and finishing trades as well as chemical works. Allied to the development of these was the growth of the paper, heavy chemical and glass industries, some of which are still in production to this day. At one point almost every type of industrial waste was being dumped into the Mersey River (Klein, 1962, p12). Additionally water was abstracted from the Mersey for industrial use; a large firm on the banks of the River Mersey engaged in the manufacture of chemicals from petroleum used about 36 million gallons of river water every day for cooling purposes (Klein, 1962, p159).

Although the manufacturing industry has declined post-1945, the River Mersey flows through two large conurbations; Liverpool and Manchester. The Mersey catchment is inhabited by 5 million people and it has been difficult to control pollution entering the Mersey for such a populated catchment. As a result local and regional control measures had to be instigated to ensure that water quality within the Mersey would sufficiently improve in an increasingly populated catchment. This was done through a series of Acts established by Government in addition to the formation of organisations such as the Environment Agency and the Mersey Basin Campaign.

2.1 Previous Pollution Control Measures

The response to polluted waterways between 1850 and 1950 was largely ineffective, resulting in further decline of the River Mersey's water quality into the mid-20th century. Pollution control methods such as the Rivers Pollution Prevention Act 1876 and the Public Health Act 1936 were designed as a means of effluent control; however the Acts post-1950 were the primary building blocks of projects such as the Mersey Basin Campaign.

The first of these Acts was The Rivers (Prevention of Pollution) Act 1951 which replaced the Rivers Pollution Act 1876. This was described as "making a provision for maintaining or restoring the wholesomeness of rivers and other inland or coastal waters of England and Wales" (Klein, 1962, p13). The Clean Rivers (Estuaries and Tidal Waters) Act 1960 extended the power of river authorities under the 1951 Act to all tidal waters and parts of the sea specified in the schedule. "The Act provided the mechanism for consolidation which required that all assets of the local authorities, water undertakers (other than statutory companies) and sewerage authorities be transferred to the water authorities" (Department for Environment, Food and Rural Affairs, March 2010). The Control of Pollution Act 1974 was the next Act instigated with the intention to "make further provision with respect to waste disposal, water pollution, noise, atmospheric pollution and public health" (The National Archives, 1974).

Jordan (1993) specified that "A growing consensus of opinion now holds that pollution control arrangements will be successful only when they are more fully integrated." Each pollution control Act built upon the previous one to incorporate a greater number of authorities to monitor pollution at an increasingly local level. Whilst their aim was to create an integrated network which could control water pollution at each level, this was not operating as efficiently as expected. Water quality in the River Mersey in the 1970's and early 1980's was so poor that immediate developments were necessary to rid the Mersey Estuary of its unenviable title of the most polluted estuary in Europe (Mersey Basin Campaign, 2015).

2.2 Potential Solutions to Merseyside's Problems

One of the main discussion contributors to discussions regarding improvements in Merseyside was Secretary of State for the Environment, Michael Heseltine (Bridges, 1981). Heseltine held this position between 1979 and 1983, and again from 1990 to 1992. He made the following statement when visiting Liverpool after the Toxteth riots:

> "[The Mersey] was enormously significant in the history of our country, and I felt a debt to that river…It was an open sewer, and I felt deeply sad that we hadn't realised what an enormous, valuable resource it was. That was where the idea came from, that we must make good the degradation of centuries" (Mersey Basin Campaign, 2015).

Michael Heseltine campaigned for funding to help ease the issue of poor water quality and inner city decline across Merseyside after rioting across Britain in the 1980's, However in a period of manufacturing decline and increased tensions between some communities and the Police, Margaret Thatcher thought funding could be better spent in smaller towns which showed greater potential (The Guardian, 2011). Nevertheless, Michael Heseltine pressed the case to save Britain's declining inner city areas and asked for £100million to be granted to Liverpool over the course of two years. His demands were met with £15million (The Guardian, 2011). In a confidential note, Conservative chancellor Sir Geoffrey Howe stated Heseltine's plans for a "massive injection of additional public spending" to stabilise the inner cities had to be rejected: "Isn't this pumping water uphill? Should we go rather for 'managed decline'? This is not a term for use, even privately. It is much too negative, when it must imply a sustained effort to absorb Liverpool manpower elsewhere – for example in nearby towns of which some are developing quite promisingly" (The Guardian, 2011).

Michael Heseltine described the outcome of postwar policy towards Merseyside as a "tactical retreat, a combination of economic erosion and encouraged evacuation" (The Guardian, 2011). However the issue of inner city decline was too severe to be neglected; Liverpool was the most deprived area in England and the North West of England. The North West had previously been a centre of industry and manufacturing, yet suffered as a result of its reliance on manufacturing jobs in a period of rapid deindustrialisation.

2.3 The Consequences of Deindustrialisation in Merseyside

In 1841 over a third of the workforce across England and Wales was employed in the manufacturing industry; in 2011 it was 9% (Office for National Statistics, 2013). This is partially due to technological advances and increased mechanisation of industry, however this decline is primarily due to deindustrialisation. Figure 1 was published by the Office for National Statistics using census data from 1841 and 2011 shows the extent to which England and Wales' combined economy has shifted. The deindustrialisation of Merseyside occurred due to multiple factors; Firstly manufacturing in the UK became expensive compared to countries in the developing world; other countries such as Japan and Germany developed the techology to manufacture more efficently. Secondly developing nations exploited cheap labour for textile manufacturing. These factors have led to a shift in the global economy, impacting on the eocnomic wellbeing of people and places occupying different positions withing the global economic spectrum (Dicken, 2003, p1).

Whilst Machester had a larger manufacturing economy, Liverpool's position as a port enabled it to establish a thriving economy based on the success of UK manufactiring and trading between the Americas, Africa and Europe. However the shift of the economy to a service based sector resulted in the foundation of Liverpool's economy collapsing, and an average of 10,000 people were leaving Liverpool every year in the 1970s (BBC, 2004).

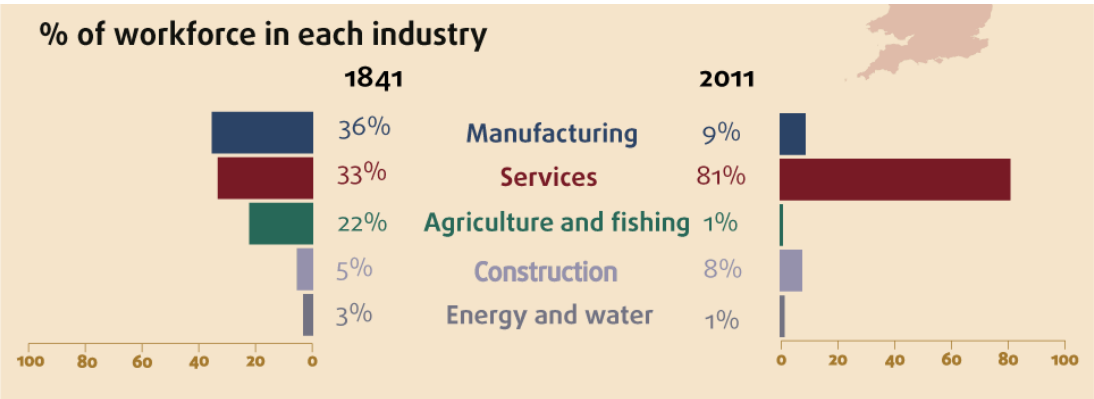


Figure 1: Percentage of workforce in each industry across England and Wales in 1841 and 2011 (Office for National Statistics, 2013)

The 1981 Toxteth riots were regarded as predictable by many senior politicians: tensions between the public and the government, particularly in Northern towns where deindustrialisation hit hardest, were at an all-time high (The Guardian, 2011). High levels of unemployment hit Liverpool far harder than many other cities across the UK, as demonstrated in Figure 2 by Meegan (2003).

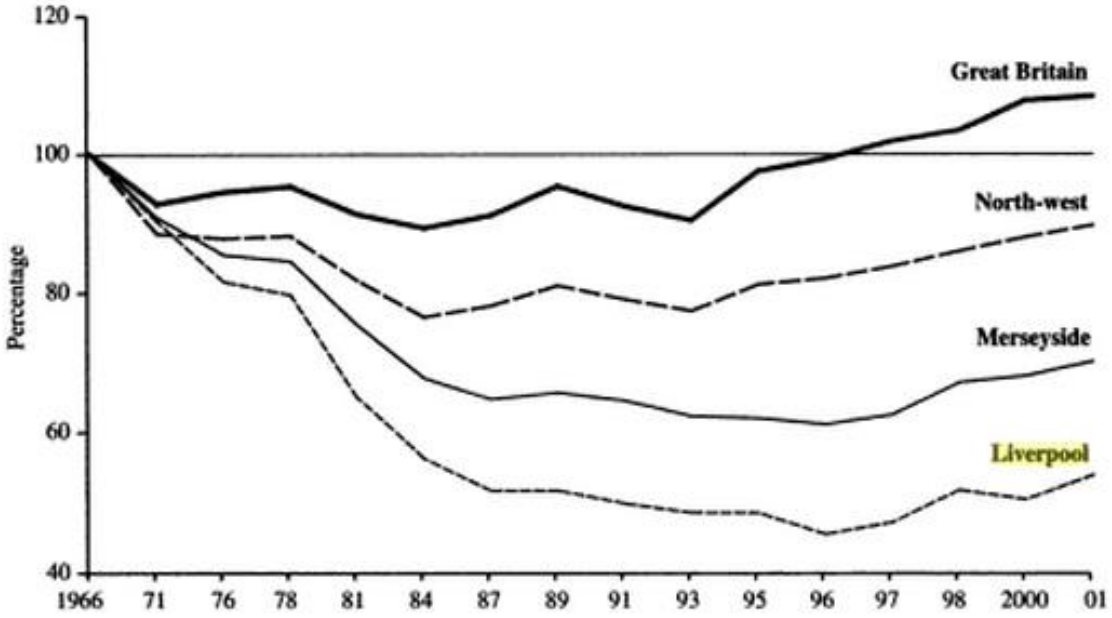


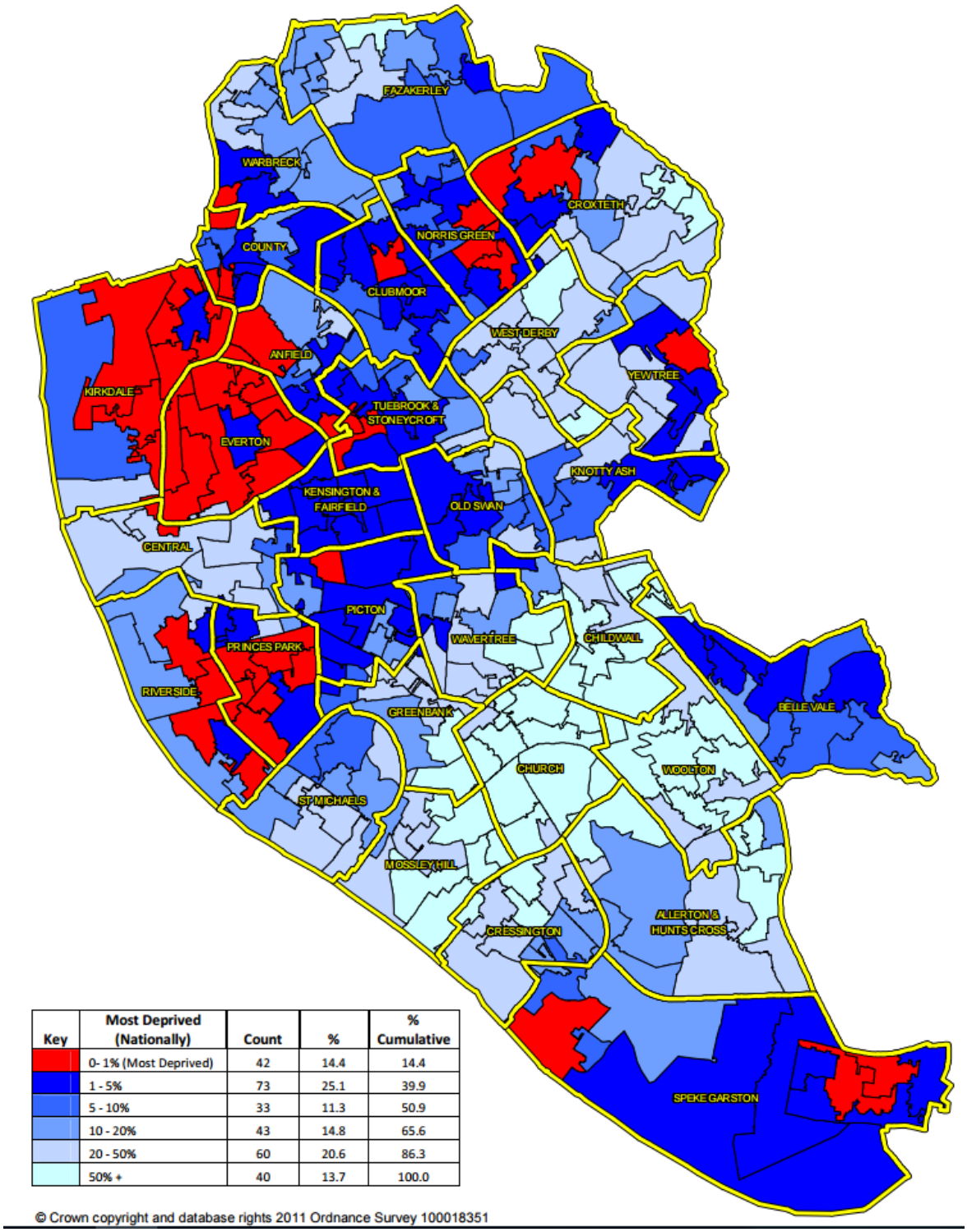
Figure 2: Percentage change in employment from 1966 to 2001 (Meegan, 2003)

Observing Figure 2, Merseyside's decline in employment was not just several times greater than the Great Britain average, but far worse than the North-West averages. Additionally Merseyside and Liverpool's recovery lagged behind the average North-West statistics, with both only starting to improve after 1996.Margaret Thatcher had stated that the "concentration of hopelessness" in Liverpool was largely self-inflicted (The Guardian, 2011) and Liverpool hosted marches opposing Thatcher's government and their attitude towards Merseyside (Parkinson, 1989). After the Toxteth riots Margaret Thatcher's closest Ministers "told her that the "unpalatable truth" was that they could not halt Merseyside's decline and her chancellor, Sir Geoffrey Howe, warned her the city was "much the hardest nut to crack" (The Guardian, 2011). This attitude towards declining inner city areas in regions which appeared to have little potential partly explains why Liverpool was in decline for decades.

According to the 1998 Index of Location Deprivation, Liverpool was the most deprived area in the country and its problems were shared by neighbouring districts. Merseyside stood out as the one county in the region with an economic activity rate below the regional mean. The department of Communities and Local Government has been monitoring deprivation since the 1970's, and the English Indices of Deprivation measures relative levels of deprivation in small areas of England called Lower layer Super Output Areas (LSOAs). Liverpool had one of the highest numbers of LSOAs amongst the 10% most deprived in 2011 as seen in figure 3, being beaten only by Birmingham (The Guardian, 2011).

The number of LSOAs in Liverpool which are in the highest deprived 50%+ category increased from 17 in 2004 to 40 in 2010, and 22% of the top 100 most deprived areas in England were located in Liverpool. In Liverpool 50.9% of the LSOAs were within the most deprived 10% nationally. Health Deprivation and Disability domain contains the highest levels of deprivation, with 17.5% of Liverpool's LSOAs in the most deprived one per cent nationally and 61.9% of LSOAs in the most deprived ten per cent (McLennan *et al.,* 2011).

The red sections of the map in Figure 3 indicate areas which are in the highest 1% of the UK in terms of levels of deprivation for 2010. Everton and Kirkdale have very high levels of deprivation as well as Anfield; Figure 3 suggests this is the most deprived area of Liverpool. However the areas of Princes Park and Riverside are also two of the most deprived areas in Liverpool. Figure 3 shows two main concentrations of these areas; around Princes Park and Everton. Whilst Everton has the greatest number of red sectors within its boundaries, Toxteth (located primarily within Riverside and Princes Park) is better known for its deprivation and poor reputation due to the legacy of the Toxteth Riots in 1981. The mention of Toxteth still creates connotations of crime and violence to people who are old enough to remember the Toxteth riots being reported on television.



Key	Most Deprived (Nationally)	Count	%	% Cumulative
	0- 1% (Most Deprived)	42	14.4	14.4
	1 - 5%	73	25.1	39.9
	5 - 10%	33	11.3	50.9
	10 - 20%	43	14.8	65.6
	20 - 50%	60	20.6	86.3
	50% +	40	13.7	100.0

Figure 3: Deprivation levels across Liverpool in 2010; red areas represent districts within the 1% most deprived in the UK (Liverpool City Council, 2013)

2.4 Toxteth's Deprivation

Whilst no academic papers have been published analysing the Mersey Basin Campaign's impact on Toxteth, there have been dozens of published newspaper articles stating that Toxteth is still suffering over thirty years after the riots. In 2006 an article published by the Liverpool Echo identified that;

> "Standard mortality rates far above the city average, and at 2.5 times the national average.
> Unemployment was at 20.4% in the Granby area and only 25% of residents in Princes Park area in full time employment.
> 72% of local children grow up with benefits as their main source of income.
> 51% of the workforce had no qualifications."

Liverpool had one of the richest multicultural heritages of any city in the UK; it has long been a crucial feature of Liverpool and has been a foundation for its diverse culture (The Independent, 2011). Its Chinatown is the oldest in Britain and Chinese migrants integrated well into the community (Broody, 1955). West African seamen also settled in Liverpool from the nineteenth century onwards, becoming an important part of Liverpool's black community and have since added to its rich and diverse ethnic composition (Frost, 1996). Racial prejudice had been uncommon in Liverpool due to its extensive port trading products from all over the world (Parker, 2001), and by the late 1970s Liverpool's black population was estimated at 8% with half having been born in Liverpool. However housing segregation has meant that historically, non-white races were confined to Toxteth (Liverpool Echo, 2006). "The black population had, after successive confrontations over the years, retreated into Toxteth" (Liverpool Echo, 2006). The Toxteth Riots were as a result of tensions between the community against the Government and police; different cultures stood united against Thatcher's Government (Amin, 2002). Whilst Toxteth has had its history of high unemployment in the 1970s and 1980s, the multicultural communities had been hit hardest by the closure of industries. "Between 1974 and 1981 unemployment among whites doubled in Liverpool, but among blacks increased threefold. In Toxteth, one in two black men were without work. Black people constituted less than 1 per cent of council employees, while in city centre shops and factories it was even less" (The Independent, 2011).

2.5 The Mersey Basin Campaign

The Mersey Basin Campaign was charged with facilitating the clean-up of the River Mersey and its tributaries, combined with the development of derelict docklands and inner city areas. Combining river rehabilitation and regeneration resulted in the proposed budget of the MBC becoming £4bn. As the MBC was the first of its type in the UK, it was crucial to establish an efficient framework (figure 4). "The development of a framework of informal intervention, local initiative and the fostering of community involvement has steadily become a prime objective of the Mersey Basin Campaign" (Wood *et al.*, 1999). The Mersey Basin Campaign Corporate Plan (2009-2010) identified the key functions at the Campaign centre: Supporting Action Partnerships, Policy development and influencing, Research and information, Partnership and programme development, Communications and awareness raising and finally Finance, administration, personnel and central services for the network. Figure 4 is a summary of the structure of the Campaign based on Wood, Handley and Kidd's (1999) paper of Urban Waterfront Regeneration in the Mersey Basin.

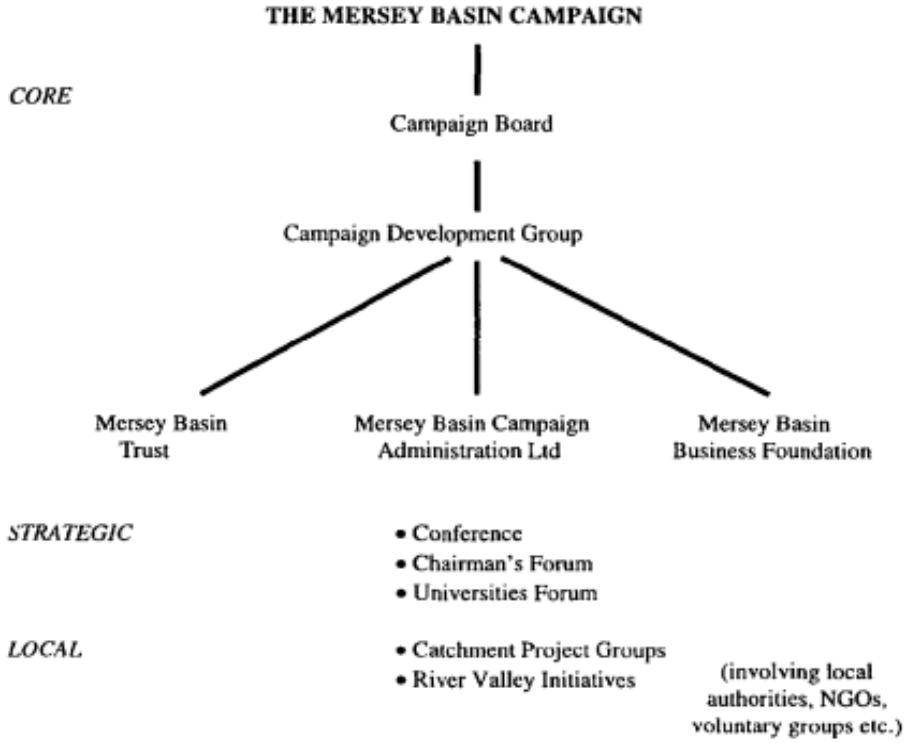


Figure 4: The Corporate Structure of the MBC (Wood et al., 1999)

Michael Heseltine realised the importance of improving water quality within the Mersey catchment. However, he aimed to focus on redeveloping land alongside the Mersey and its tributaries as a response to the cause of the Toxteth riots, and to make the project economically viable. Wood and Handley (1999) highlight the importance of waterside location and clean water in developments:

> "A small survey of commercial property valuers was used to explore this relationship and revealed the importance of water in the property development process, through potential increases in value and an enhancement of the marketability of property adjacent to water. Equally, improved water quality is revealed as an important precursor to waterside economic regeneration".

Combining water quality and regeneration projects would ensure that Liverpool repair some of the damage caused by industrialisation whilst improving its future economic prospects. Sustainable watercourse management and the combination of medium-sized corporations and stakeholders into the Campaign provided a focal meeting point to pool resources and set goals for decentralised, reflexive structures. This was critical if contemporary top-down approaches were to be modified to foster adaptive ecosystem-based applications that incorporate participatory decision-making at a catchment scale (Gregory *et al.,* 2011). The Campaign's structure was specifically developed to encourage local authorities to come together to ensure the water quality was improved as a stimulus to economic activity.

Before the inception of the Mersey Basin Campaign, Michael Heseltine was informed that he could not simply clean up the Liverpool end of the river due to pollution continuing to enter the Mersey upriver. Untreated sewage, pollutants and noxious discharges were described as contributions to water conditions and environmental standards that were perhaps the single most deplorable feature of the Mersey. Therefore a successful clean up required the engagement and participation of myriad different organisations, authorities and communities (Mersey Basin Campaign, 2015). However an organisation such as the Environment Agency was not formed until 1996, meaning water quality data for the first ten years of the MBC is scarce and inconsistent, despite the MBC being awarded the inaugural winner of the International Thiess Riverprize for best river system clean up in 1999 (Mersey Basin Campaign, 2015).

2.5.1 Key Investors and Successes of the Mersey Basin Campaign

It has been difficult to pinpoint individual projects conducted with the financial backing of the Mersey Basin Campaign due to a lack of documentation between 1985 and 2010. There have been summary reports produced at the midpoint of the MBC and at its termination, however researching projects funded by the MBC proved difficult throughout this research. Following on from Figure 4, the MBC's corporate structure included several large corporations which had a vested interest in the potential of the MBC

2.5.2 United Utilities

A primary stakeholder in the Mersey Basin Campaign's corporate structure which provided key investment is United Utilities. The Mersey Basin Campaign (2008) states that United Utilities worked in very close alignment of the Campaign's objectives and "whilst short-term improvements matter, both organisations have a commitment to the long-term development of the region." United Utilities involvement with the MBC was beneficial to both parties; however United Utilities had an interest in the project for financial gain amongst other incentives. The Mersey Basin Campaign (2008) listed a series of benefits which benefitted both parties;

> "Better influence key stakeholders (e.g. Ofwat, Environment Agency) on the key strategic policies (Periodic Review, Water Framework Directive, Regional Economic Strategy/Regional Spatial Strategy).
>
> Gain publicity which promotes the value of water quality improvements and the benefits they bring to the local economy and communities.
>
> Promoted positive messages about United Utilities' role in these improvements and gave the company a high profile at the annual conference (attended by 250 other stakeholders)."

United Utilities sponsored the work of the Council, supplied employees to work on policy and projects, sponsored and supported Action Partnerships through direct funding and provision of office facilities for three local co-ordinators and provided sponsorship towards the Campaign's annual conference and magazine.

2.5.3 Peel Holdings

Peel Holdings is currently one of the leading property and transport companies in Britain, and the majority of its operations are based in the North West of England. The company deals with property investment and development to owner-operator of the Manchester Ship Canal, Liverpool and Birkenhead Docks, Liverpool Airport and the Trafford Centre. The Manchester Ship Canal Company was one of the founding members of the MBC (Mersey Basin Campaign, 2008). The business case study of Peel Holdings available on the MBC website is poorly constructed and not very informative, however the MBC (2008) states that "The company is a major stakeholder in the region; it owns a major waterway. Its interests in long term sustainable development of both land and business (especially transport) are very much aligned with those of the Campaign. It sees partnership working as a means to engage with the local community in all sectors (business, government and voluntary)."

One of the best successes of the MBC in conjunction with Peel Holdings is the regeneration of Salford Quays, the details of which are covered later in this thesis. The company has also been involved with the regeneration of the Liverpool Docks which was a crucial development in conjunction with the development of Liverpool One shopping centre. The Peel group has also been involved in specific projects such as the development of the coastal reserve at Speke/Garston and proposals for the Mersey Observatory. The company is also a stakeholder influencing work by the Healthy Waterways Trust on water quality in the Manchester Ship Canal (Mersey Basin Campaign, 2008).

2.5.4 Liverpool One

Whilst Liverpool One was not directly involved with the MBC, it has capitalised on its success. Liverpool One was a method of retail-led development and the shopping centre opened in 2008 after planning since the late 1990s. Its opening coincided with Liverpool's European capital of Culture award for 2008 which is examined further later in this thesis. Liverpool One consists of over 160 stores and restaurants, a 14 screen cinema and a five acre park in the heart of Liverpool city centre (Liverpool-one.com, 2015).

2.6 The Role of the Environment Agency

The Environment Agency (EA) was created in April 1996 as a Non-Departmental Public Body set up under the Environment Act 1995. The EA was an amalgamation of Her Majesty's Inspectorate of Pollution (HMIP), National Rivers Authority (NRA) and Waste Regulatory functions of local authorities. The EA has been heavily involved with the Mersey Basin Campaign, with the MBC taking most of its water quality indicators directly from the EA. A Mersey Basin Campaign report stated "Regular environmental monitoring by the Environment Agency has led to improved understanding of the complexity of many of the pollution problems, and an identification of where the major problems are. Currently, they monitor chemical and biological indicators as measures of river quality, but these only tell a partial story." However in the final ten years of the MBC, the EA collected four categories of data to provide a comprehensive water quality assessment analysis; Biology, Chemistry, Nitrates and Phosphates.

Fears concerning the loss of aquatic habitat resulted in the broadening of the Environment Agency's scheme to expand environmental interest and river programmes designed to rehabilitate rivers. Nolan and Guthrie's 1998 paper on river rehabilitation in urban environments from the Mersey Basin listed a series of additional aims for the EA to achieve in the Mersey Basin alongside the MBC.

> Create and restore habitats within river corridors for wildlife to thrive.
> Improve the recreational value of the sites.
> Create a more 'natural' watercourse, encouraging it to be self-sustainable.
> Increase public awareness for the water environment.
> Involve local people and schools in decision making, and provide educational benefits.
> Implement work on the ground and adopt an integrated approach at all stages of design and construction.
> Monitor effectiveness through the use of post- project appraisal (Nolan and Guthrie, 1998).

The role of the Environment Agency is documented further throughout this thesis as some of the data used has been provided by the Environment Agency.

2.6.1 Fish Stocks: Populations in the Mersey Catchment

Biological and fish stock data is used by the Environment Agency as well as the European Union Water Framework Directive as part of their criteria to assess water quality of rivers. However water quality and fish stocks data is scarce up to the 1960s for the River Mersey as an organisation such as the EA did not exist. Therefore it is difficult to pinpoint the approximate time frame where the Mersey was effectively 'dead'. During the 1960's the local pollution authority authorised the collecting of water quality data in order to obtain long term trends on prevailing conditions (Jones, 2000). This data is not easily accessible; there are few academic papers which clearly reference comprehensive fish stock data in the Mersey over the past few decades. Additional data obtained on behalf of United Utilities by APEM in 2007 further revealed the extent of lack of data regarding fish populations within the River Mersey. APEM reported that due to heavy rainfall, data collection throughout their study was restricted to two sites on the Micker Brook, a tributary of the Mersey. Although 12 fish species were recorded, low numbers of each were actually caught, and some of the species present such as crucian karp having probably escaped from an ornamental fishery (APEM, 2007). Whilst this data is not entirely relevant to this thesis, it helps summarise the attitude to monitoring water quality and making it accessible to the general public: what little data there is was hard to obtain and monitoring was sparse.

The River Restoration Centre compiled a report in 2005 by Bannister *et al*. which concluded that "the Mersey's water quality has improved dramatically with salmon returning to the river for the first time in 150 years, however the North-West still lags behind other regions in terms of river quality so further work is required". However Jones (2006) counteracts this by stating that the Mersey Catchment is now a world leader in river management strategy. The reality is that the restoration of the lower section of the Mersey has been far more successful than the upper Mersey, and eels and migratory lamprey species have failed to capitalise on improvements to the Upper Mersey Catchment (APEM, 2007). High densities of these species are present in the lower catchment within the Mersey Estuary, but barriers prevent their migration upstream: 500 physical barriers such as weirs were identified on the River Mersey which act as barriers to migratory species (APEM 2007). These barriers also prevent the genetic mixing of fish stocks, leading to serious implications for natural recolonisation following localised fish kills.

2.6.2 The Importance of Biotopes in an Urban River

A biotope is regarded as an area with uniform environmental conditions providing a habitat for a specific assemblage of plants and animals (Sukopp and Weiler, 1988). There have been recent developments in biotope definition and spatial distribution based on broad ecological categories that are easily recognizable by unskilled surveyors, meaning categorising them is undertaken by the Environment Agency and can be conducted quickly for a stretch of river (Alvaro *et al.,* 2008). The hydraulic character of biotopes has been shown to have links with macroinvertebrate communities (Entwistle *et al.,* 2010); Biotopes are important in urban rivers as individual species reside in diverse biotopes at different stages of their life.

In order to improve the biological status of an urban river, biotope restoration schemes are often implemented in stretches of river which cannot flow as they would naturally. In a paper published by Rodríguez *et al.,* 2000, the authors explain that "The definition of this pre-disturbance state is often difficult, if not impossible, in human-dominated environments. Moreover, setting the predisturbance state as a design goal can be unpractical since this pristine state could be impossible to achieve or unsustainable. For urban streams, a more suitable concept is stream naturalization where the goal is to enhance hydraulic, morphologic and biological diversity". The River Mersey catchment is too urbanised to allow the whole length of the river to flow naturally in order to return the river to a 'pristine' state. Kasahara and Hill (2008) stated that "many restoration projects are designed to rehabilitate ecologically damaged or degraded reaches, but habitat improvement strategies are also used in mitigation projects such as the construction of new channels in residential and industrial development sites." This attitude towards rehabilitation on stretches of the Mersey is more appropriate. Artificial pool-riffle units are primarily installed in rivers which are heavily engineered. They are a method of enhancing biodiversity in a river which is already relatively natural that the water quality is enough to sustain a variety of wildlife, including basic indicator species (Landres *et al.,* 1988).

The removal of river engineering works has becoming increasingly common; however successful schemes have not been documented as effectively as possible. One example is Ashton Weir on the River Mersey; the project has not been well-documented in academic literature or by environmental partners. This project involved

the construction of a fish pass enabling upstream migration. The restoration work undertaken near Ashton Weir was an extension of previous work of removing embankments allowing the river to flow a more natural course as well as improving water quality upstream. The addition of biotope restoration schemes enables the formation of a variety of habitats for migratory species. Meador and Goldstein (2003) stated the importance of understanding relations between basin land use, riparian zones and in-stream ecosystems which can be influenced by land use at regional or broad geographic scales. This approach is utilised all over the UK, and is enforced in part by The European Union Water Framework Directive.

2.6.3 The European Union Water Framework Directive

The European Union Water Framework Directive (WFD) was instigated in 2000 and established a series of water management goals across 27 countries (Kallis and Butler, 2001). Almost half of correspondents were concerned about water pollution and agreed that waters contaminated by industrialisation and waste disposal should be improved to reduce pollution and increase biodiversity. The WFD set new goals for the condition of Europe's water and introduced new means and processes for achieving them. The overall goal is a “good” and non-deteriorating status for all waters; surface, underground and coastal (Kallis and Butler, 2001; Borja, 2006), with a target year of 2027 having been extended from 2015. As the UK is a member state it must adhere to the WFD’s goals of improving the status of its rivers to a sufficient standard, however achieving “good” status is not always possible. Despite stricter control on effluent disposal, the fact that the Mersey catchment is home to around 5 million residents means there will always be a baseline level of pollution entering the river. Therefore the concept on a non-deteriorating “status” was introduced by the WFD which is a more realistic aim for rivers flowing through heavily urbanised catchments.

The MBC was instigated fifteen years before the WFD, and the success of the MBC was credited whilst discussions for the WFD were being undertaken. Additionally some of the successes of the MBC were also mentioned in documents outlining the role of the Environment Agency when it was initially established.

2.7 Successes under the Mersey Basin Campaign

There have been many successes under the Mersey Basin Campaign related to improvements in water quality and pollution control; however the projects which have garnered the greatest media coverage have been connected to regeneration. Liverpool City Centre has seen the greatest level of investment across Merseyside. In 2003 private investors agreed to invest £1 billion to regenerate 42 acres (17 ha) of the city centre by creating Liverpool ONE, at the time the largest city centre regeneration scheme in Europe (Daramola-Martin, 2009). The complex was built around existing streets and the 1.65 million sq. ft. open-air complex included over 160 stores, bars and restaurants, 14 screen cinema, indoor adventure golf course and a five-acre park (Liverpool-ONE, 2015). Liverpool ONE was a project designed to utilise much of the derelict or underused land in the city centre. "The combination of these factors was to set in motion the physical transformation of the city and an emotional change in attitudes and perceptions, suggesting that Liverpool had found its way out of a succession of failed initiatives, underinvestment and economic decline" (Daramola-Martin, 2009).

By 2003 Liverpool's city centre was several years into its regeneration through the promotion of its cultural heritage. The announcement of Liverpool ONE in 2003 was the year after the announcement that Liverpool would be the European Capital of Culture for 2008. Jones and Wilks-Heeg's 2004 paper on the Capitalising culture of Liverpool 2008 highlights the juxtaposition in the Liverpool 2008 process; they highlight the discourses of urban entrepreneurialism with a strong emphasis on community involvement. Their paper also highlights tensions arising from the re-branding of Liverpool as 'The World in One City' and the threat that the emphasis on culture as economic development poses to the 'alternative' culture in the city centre. Many regeneration schemes risk dividing the local community; increases in house prices due to increased competition in desirable locations push poorer residents out of an area and can cause social divide. However the success of Liverpool ONE has dramatically improved both tourists and residents perception of the city centre, derelict land is now being used and there has been millions of pounds in further investment in the city centre. The area has become a cultural hub highlighted by Liverpool's European capital of Cultural award, and the projects undertaken to achieve this status have been consistent through the time frame of the MBC.

2.7.1 Liverpool Festival Gardens

The International Garden Festival took place in 1984 on a partially reclaimed site in South Liverpool. When the International Garden Festival was awarded to Liverpool, the budget was just £17million. In comparison, the Dutch and German Garden Festivals which was held the previous year's took five years to plan at a cost of $90 million. The Festival Gardens was one of the most ambitious regeneration projects of its type in the UK at the time; The festival was over budget at £17.85m, however £8.08m was recovered in income from visitors throughout the festival which ran from May to October (Fieldhouse, 1984). When part of the eroding foreshore of the Mersey Estuary was reclaimed by the deposition of 6.4 million tonnes of domestic waste behind a 10 metre high retaining wall, there were problems with settling, some areas of the site as much a 6mm a week (Raybould et al., 1985). Due to issues such as this, the project had to be rushed to ensure it would open in time, and led to it being £850,000 over budget, however the International Garden Festival attracted 3.8 million visitors at its peak and was considered very successful. The Liverpool Festival Gardens were designed to meet a variety of visitor needs and was developed as a multifunctional site (Neilson, 1985). The Garden Festival was not just a means of regenerating one of Liverpool's most deprived areas; one prominent feature of the Festival was a "Health Fair" integrated with other community activities (Hussey *et al.*, 1987). Once the festival finished, a large part of the site was developed into residential housing while the remainder experienced various incarnations as leisure and entertainment facilities until it was left derelict in 1997 and fell into disrepair.

Whilst gardens still existed on the site after its dereliction, plans for another housing development were instigated and in 2006 the festival dome was demolished. Included in the development report were plans for 1000 homes and plans to redevelop the old gardens. However the developer, McLean, filed for bankruptcy, pushing back redevelopments. In 2007 funding was granted by Liverpool City Council to another company, Langtree, to start a scheme of urban redevelopment work beginning in 2010. In 2011 the gardens were renamed 'Festival gardens' and opened to the public. The dereliction of the gardens was regarded as 'a blessing in disguise' by some residents as over the thirty years since the International Garden Festival, many of the planted trees had reached maturity; some of the trees in the gardens only needed pruning, the framework for the garden and the exotic plants were already there. The

recent development on part of the Gardens site was originally calculated to cost over £100m and covered 40 hectares of land, 26 hectares of which was undeveloped parkland. It was predicted to create 1700 jobs, 700 of which would be part time. The public also retain free access to the parkland.

2.7.2 Liverpool's European Capital of Culture 2008

Liverpool was awarded the European Capital of Culture Award for 2008, demonstrating the extent to which the rebranding and regeneration of Liverpool City centre had been achieved. The award was announced in 2003 and the BBC reported that the renewal of Liverpool's waterfront, a World Heritage site and home to cultural centres like Tate Liverpool, had strengthened its credentials. The opening of the Film Arts and Creative Centre, FACT, the UK's only exhibition and performance space dedicated to film, video and digital art also helped Liverpool gain the award.

Liverpool John Moores University and the University of Liverpool worked on a joint initiative between 2005 and 2010 to assess the environmental, economic, social and cultural impacts of Liverpool hosting the European Capital of Culture in 2008. The research commissioned by Liverpool City Council was designed to examine the progress and impact of the award on Liverpool and its people. Throughout the Impacts 08 report written by Garcia, Melville and Cox (2010), the Liverpool European Capital of Culture was abbreviated to Liverpool ECoC, and the term Liverpool 08 refers to the brand dimensions of the programme. The Impacts 08 scheme was subdivided into five categories; Pre-bid (2000), Bidding and Nomination stage (2002-2003), Event lead-up (2004-2007), Event Year (2008) and Post event (2009). This framework enabled the project to be developed from the perspective of a series of stakeholders. Equally, the framework focused on economic, social and cultural dimensions of Impact 08, again grouped into five categories: Cultural access and participation, Tourism and Economy, Cultural Vibrancy and Sustainability, Image and perceptions and finally Governance and delivery process. The Liverpool European Capital of Culture programme was allocated £130m; the highest budget awarded in the UK for such a project. From 2005 to 2008 there were over 41000 activities including 21000 performance and exhibition days, 20000 workshops and training sessions and 276 highlight events (Impacts 08

Report, Garcia *et al.,* 2010). This resulted in a total audience of 18 million people, as well as a thousand volunteers giving up seven thousand days' worth of time to help organise and run the event (Impacts 08 report: Garcia *et al.*2010).

2.7.3 Case Study of Salford Quays

Salford Quays, located about a mile from Manchester City Centre, is one of the North-West's biggest success stories in urban regeneration and water quality improvements. Although the MBC is not listed as an official sponsor, the MBC operated in conjunction with a series of additional stakeholders, many of which were connected to the redevelopment of Salford Quays and the construction of Media City. The history of Salford Quays is similar to that of Liverpool; the Quays were a success based on the manufacturing and trading of products in the North-West of England.

Assessing the Salford Quays development, in hindsight the Council should have made more effort to ensure that a greater percentage of the people employed at Media City were local residents. Instead many employees were people who had relocated and already employed by the BBC. "Of the 3,172 people from Salford, Greater Manchester, who applied for jobs at MediaCity, just 24 were successful" (The Guardian, 2012). Additionally, "eight out of the 24 people from Salford who did secure employment were on six-month "ambassador" contracts for 16 to 19-year-olds, paying between £3.64 and £4.92 an hour to meet, greet and look after guests" (The Guardian, 2012). Only 246 of the remaining 680 jobs were given to people living in Greater Manchester. One of the criticisms of large regeneration projects such as the redevelopment of Salford Quays is that the projects do not always help the local population who need the most help. Local residents can be priced out of their own communities if there is an influx of workers from outside the area; many of the created jobs were filled by workers from London or the BBCs previous offices on Oxford Road in Manchester who relocated to retain their job. Media City is a prime example.

The redevelopment of Salford Quays has been a success for a variety of reasons, but would only have been successful if the companies involved worked in conjunction to ensure that a common goal was reached. The isolation of water within the Quays from the Manchester Ship Canal was a principal proposal of the development plan, and the

water-treatment system which was installed has been highly successful in creating a thriving aquatic ecosystem and enabling water-based recreation activities to take place (Struthers, 1997). The concept of a "media city" ensured Salford Quays became a sustainable mixed-use site based on improving water quality and a living environment.

2.8 Gaps in Research

Despite the media and the Mersey Basin Campaign's official website reporting the Mersey Basin Campaign as a resounding success, there is little academic research to back this up. Some of the best data sources on the Mersey Basin Campaign have been from Wood, Handley and Kidd's 1997 and 1999 papers as well as Jones' 2000 paper and Struthers's 1997 paper, but little else has been published since which covers the MBC in much detail. There have been few academic papers produced after the mid-point of the Campaign's time frame, and detailed data available from the Environment Agency is scarce.

Documents published in conjunction with the Mersey Basin Campaign do not highlight many individual projects which were undertaken. Due to the scale and overall cost of water quality improvements within the Mersey catchment, documenting and monitoring successful and failed projects could have provided a great learning opportunity for similar projects which may be introduced across the UK over the following decades. With increasing urban populations and an increased awareness of the importance of preserving the environment, the significance of biotopes in urban rivers in order to improve their biological capacity should be of increasing importance. There is little to no information regarding these schemes within the Mersey Catchment which is accessible. There is little reference to which schemes have been successes and failures, and it is therefore impossible to document which techniques may prove more efficient and economically viable than others in certain field sites.

2.9 Aims and Objectives

The aim of this thesis is to examine how successful the Mersey Basin Campaign has been in achieving two of its original aims and whether Toxteth's economic prospects have improved as a result. In order to do this, it is necessary to refer back to the MBC's original aims:

> To improve river quality to at least fair standard by the year 2010 so that all rivers and streams are clean enough to support fish;
>
> To stimulate the development of attractive waterside environments for businesses, housing, tourism, heritage, recreation and wildlife.

The MBC was established under the awareness that these two variables were closely connected, as reported by Wood *et al.* (1999). The results of water quality improvements and previous mid-term reports for the MBC published between 1995 and 2000 (e.g. *Wood et al.,* 1997) stated that the MBC was on track to meet its aims by 2010; however this primarily references improvements in water quality. There is little detailed examination as to how effectively the MBC was encouraging development of attractive waterside locations to stimulate local economies in declining inner city areas. The report praises the MBC's links with Development Corporations such as the Central Manchester Development Corporation, Trafford Park Development Corporation and Merseyside Development Corporation, but acknowledges many projects, although not carried out directly under the Mersey Basin Campaign, nevertheless contribute to the Campaign's objectives of revitalisation of watersides (Wood *et al.,* 1997). This makes it increasingly difficult to determine which development schemes were conducted under the MBC; therefore the primary research area has been selected based on its proximity to waterside locations and access to council data. Toxteth was selected as the main research area to assess whether developments of attractive waterside locations led to visible improvements in economic activity.

In order to assess how successful the Mersey Basin Campaign has been, there are two primary research questions addressed in this thesis:

What was the state of water quality across the watercourses in the Mersey Catchment at the end of the Mersey Basin Campaign, and how has it improved over the final ten years of the Campaign?

To what extent has the Mersey Basin Campaign been successful in improving Toxteth, one of the most deprived areas of Liverpool?

In order to answer these objectives, a series of explicit objective questions need to be identified and answered:

How have water quality grades changed across a series of selected field sites located across the Mersey Catchment?

Do Toxteth's unemployment, child poverty and additional statistics show that Toxteth has recovered from its post-war decline and negative reputation from the 1980s?

The justification for using Toxteth as a research area is due to the MBC being a response to the Toxteth riots in 1981. Secondly the MBC had a realistic 25 year time frame in which to complete its aims and enough time has elapsed since the end of the MBC to evaluate its success. The Healthy Waterways Trust and the Atlantic Gateway continues aspects of the Mersey Basin Campaigns work, however most of the work across the Mersey catchment was conducted over the twenty-five year time frame of the MBC. Extensive literature is available regarding the history of pollution within the Mersey Catchment (for example Craig and Morton, 1976: Langston, 1986: Wood *et al.*, 1999: Jones, 2000) which also covers both the history of Liverpool and the midpoint of the MBC, ensuring the Mersey's history is well documented. In 2004 the Mersey Basin Campaign added the geographical area of the River Ribble catchment to the Campaign. Figure 5, taken from Wood, Handley and Kidd's 1999 paper, shows the geographical extent of the MBC's geographical area before the addition of the River Ribble catchment in 2004. The water quality data used in this thesis has been taken from this area rather than the Ribble catchment as it was only added to the Campaign six years before it finished. Secondly most of the academic literature which was produced around the midpoint of the Campaign's life span does not include the updated geographical area. Thirdly when the MBC started in 1985 it only focused on the Mersey Catchment as this was one of the most polluted rivers in the UK; the River Ribble was far less polluted and needed much less investment.

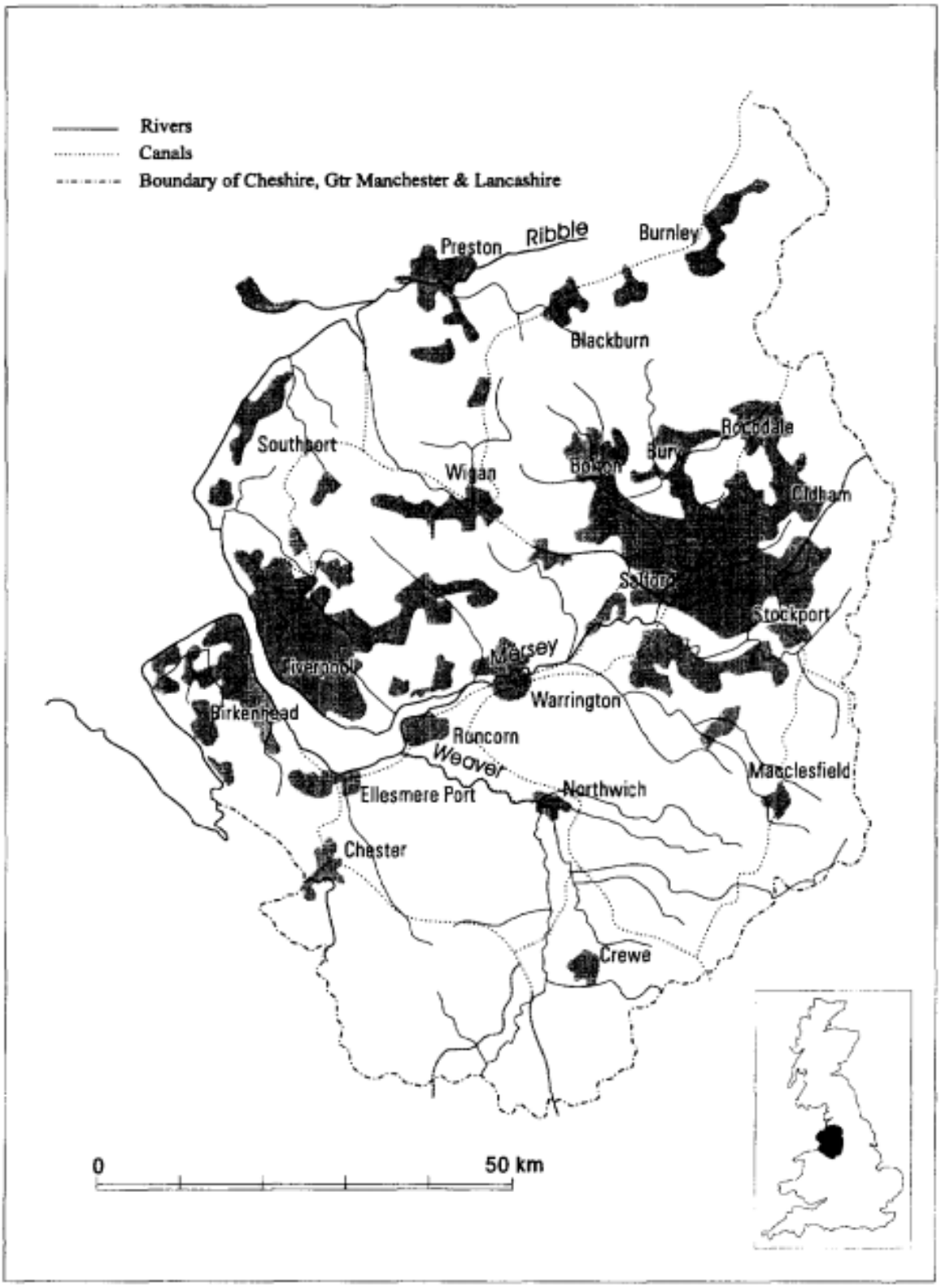


Figure 5: The geographical area of the Mersey Basin Campaign before the addition of the Ribble catchment in 2004 (Wood et al., 1999)

3. Research Area

The River Mersey and its tributaries drain a catchment of 4680km^2 within the North West of England in which five million people live (Ridgway & Shimmield, 2002). The Mersey Basin Campaign (2010) states that the River Mersey is 70miles (112km) long of which the estuary is 16 miles (26km), and the river starts at the confluence of the River Tame and the River Goyt in Stockport. The Mersey flows west towards Liverpool, flowing through South Manchester towards Warrington where the river becomes tidal at Howley Weir (Mersey Basin Campaign, 2010). Both Liverpool and Manchester were two of the first cities to rapidly industrialise in the 19th century, meaning the River Mersey has suffered a legacy of neglect and abuse which prompted a clean-up operation starting in the 1970's (Jones, 2000). The field sites selected for use in this thesis for analysing water quality have been collected within the catchment area shown in Figure 5.

3.1 Toxteth

The boundaries of Toxteth today are very different from its historic boundaries. Toxteth Park initially covered a larger area but development has seen the area of green space reduced to the extent where there are now just two areas of open green space, only one of which is located entirely within Toxteth's current boundaries. Farrer and Brownbill published details on the condition of Toxteth Park in 1907: "The total area is 3,598 acres of which about half, 1,737 acres, was taken within the borough of Liverpool in 1835, and with the exception of Prince's Park is now quite covered with streets of dwelling houses. The outer half, with the exception of Sefton Park, containing 387 acres, has, within recent years, fallen largely into the hands of the builder. This portion also was included within the borough of Liverpool in 1895."

Toxteth's changing boundaries have resulted in Sefton Park being classed within another area of Liverpool, St Michaels Ward. Princes Park is the only large green space located entirely within Toxteth's current boundaries. Figure 6 shows Toxteth's current boundaries, the location of Princes Park as well as its proximity to Sefton Park.

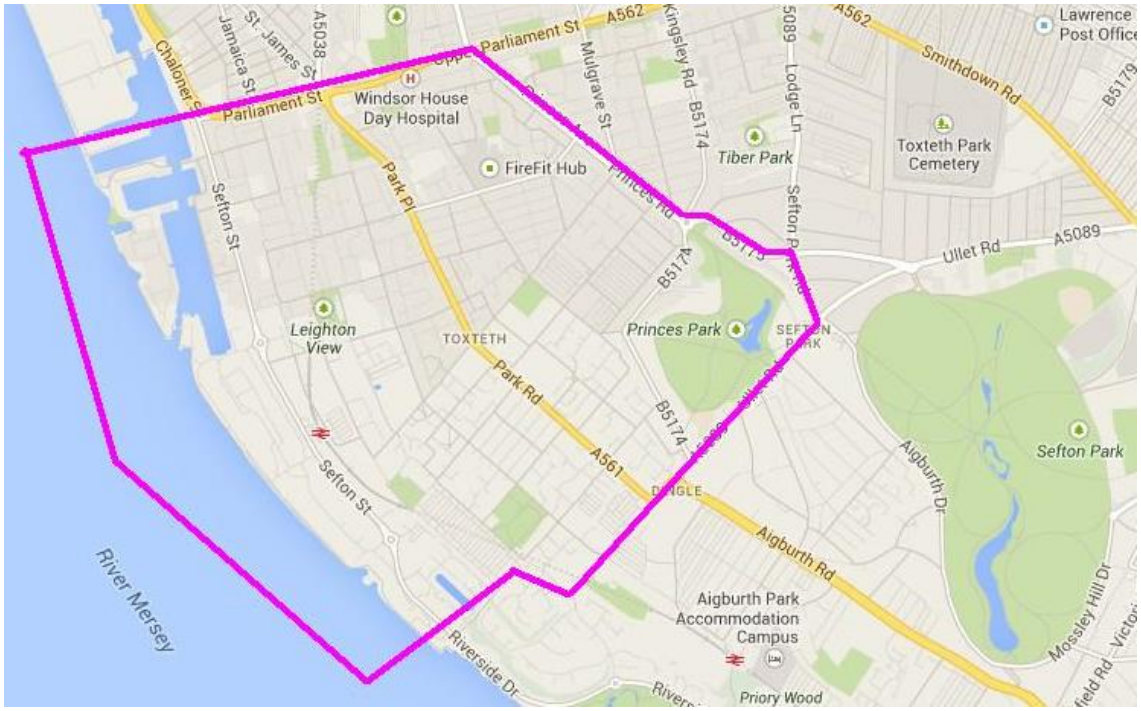


Figure 6: Toxteth's current boundaries highlighted in pink

3.2 Sefton Park

Sefton Park is a 235 acre park located in the Sefton Park district of Liverpool. Whilst parts of it fall within St Michaels ward, the whole park falls within the historic boundaries of Toxteth Park and is listed as Grade I by English Heritage in its Register of Historic Parks and Gardens. Sefton Park has received funding since the start of the Mersey Basin Campaign but the money has not come directly from the Campaign itself. The money raised to repair a Palm House was funded by the Heritage Lottery Fund which invested £2.4m (BBC, 2011), and they have invested £520m altogether across Merseyside (Heritage Lottery Fund, 2015). Sefton Park initially received £200,000 in 2004 which was used to set up a team of landscape architects, tree surgeons, ecologists, engineers and water feature experts to develop plans to improve the site (BBC, 2011). In December 2004 Sefton Park received additional funding of £4,958,000 from the Heritage Lottery Fund to fund the refurbishment of the café, improvement to the water features and the children's play area (Heritage Lottery Fund, 2015). The park now contains angling facilities, boating lake, children's play area, cycling facilities, bandstand, two cafes and is classified as a Green Flag Award and Green Heritage Award winning site.

3.3 Princes Park

Princes Park is located entirely within Toxteth (figure 6) and was opened in 1842. The park is far smaller than Sefton Park at just 45 acres, however its popularity led to the formation of Sefton Park almost three decades after Princes Park opened. Princes Park is Grade II listed by English Heritage and has limited amenities. The amenities which remain in Princes Park in 2015 are tennis courts, angling facilities, a children's play area and the foundations of the former grade II listed boat house. This park is not as accommodating for families as Sefton Park; however this has resulted in Princes Park becoming a very popular angling site. The park is far quieter than Sefton Park and is used as a walkthrough to areas of Toxteth. Both parks hold different events and attract different audiences.

3.4 Summary

Both Sefton and Princes Parks have had millions of pounds invested in them to improve the facilities available to the public, and whilst little money has been spent in the past 5 years, millions were spent before 2010 (Heritage Lottery Fund, 2015). It is important to assess to what extent the schemes have been successful and to what extent Wood *et al.*'s (1999) statement relates to the MBC, and Toxteth is an ideal research site.

Wood *et al.* (1999) summarised the Campaign as "a model for engaging co-ordinated environmental action through a partnership approach." The Campaign targeted two issues: the twin problems of poor water quality and dereliction of buildings were intimately connected and should be treated as such. The initiative aimed to clean up the Mersey estuary along with its tributaries and restore associated degraded land to optimum use, whether it is for industry, housing or amenities (Wood *et al.,* 1999). Therefore the Mersey catchment, described as one of the most successful water quality improvements in the last century (Jones, 2000), is the optimum research area to assess how connected water quality and urban regeneration are connected.

4. Methods

In order to test the hypothesis, detailed datasets needed to be collected, analysed and assessed in detail. The level of data necessary for this research could not be conducted by an individual due to the size of the study area, therefore data needed to be obtained from additional sources. Due to the nature of this research and the level on which the Mersey Basin Campaign was conducted, the only reasonable research method was a quantitative approach. This would allow for comparisons to be made year-by-year, as well for allowing a detailed analysis of Toxteth at the termination of the MBC. Two primary sources of data were used; the Environment Agency data sets are purely numerical due to the extent of the research area, the number of surveys conducted and the frequency of which they were conducted. After initial research as to the methods and sources of potential data sets, the data collected by Liverpool City Council was by far the most comprehensive and recent data available in order to assess any potential impacts of regeneration within Liverpool and whether Toxteth has been affected. The Liverpool City Council data uses a variety of sources for its data, however all the statistics produced follow the quantitative approach method.

The justification for using this research approach was that it was the best method available for the geographical area that needed to be assessed. Whilst the primary data is described as quantitative, the predictions made at the end of this thesis for the future of Toxteth are based both on statistical data and additional information pertaining to future developments and projects which have been researched primarily through accessing newspapers and online material. Ultimately the predictions made in the discussion and conclusions of this thesis are derived from a mixed methods approach.

Several sites were considered however the field sites were ultimately selected based on the amount of data which could potentially be collected. After initial research it became apparent that there were large gaps in the data which should have been provided by both the Mersey Basin Campaign and the Environment Agency. It was very hard to pinpoint exactly what projects were undertaken and how much was spent; therefore potential field sites were limited. Toxteth was chosen as a field site partially due to the publicised Toxteth Riots; many articles and papers were published in the years after the riots. Additionally the redevelopment of Sefton and Princes Park was well documented not just in the media, but by their sponsors.

4.1 Data Collection

As two sets of data were necessary, the data was obtained from two sources. The majority of the data was obtained by contacting Liverpool City Council who offered the relevant data readily. The data collected by Liverpool City Council for the Merseyside area was collected in 2013 and is the most recent data accessible at the start of this research. In order to further assess the impact of the Mersey Basin Campaign on improving water quality, data was obtained online from the Environment Agency regarding water quality samples taken across the UK between 2000 and 2009. The data from 2009 was the most recent data which was accessible online, and the data was taken a year before the end of the Mersey Basin Campaign, meaning the Campaign was starting to come to an end. The majority of water quality improvements should have been completed within this time frame.

4.1.1. Liverpool City Council Data

Liverpool City Council (LCC) is obliged to release the council data they collected under the Freedom of Information Act 2000. Data was obtained by emailing Liverpool City Council and asking them to either send the necessary information or direct to a source where it could be obtained. The council replied with an email with a link to all the information across every Ward in Merseyside which was then examined, and the necessary data was extracted and processed using Microsoft Excel. The aim was to produce a series of graphs showing comparisons between Riverside and Princes Park Wards then compare these to Liverpool Average and National Average statistics. The data from LCC is categorised by ward rather than town, therefore there are areas of Toxteth which overlap into different wards. A ward is defined as a division or district of a town, as for administrative or political purposes, therefore data gathered from the wards of Riverside and Princes Park are being used to assess the current state of Toxteth as Toxteth falls within these boundaries

The data gathered by Liverpool City Council was taken from a range of sources, primarily government departments. The listed sources for the data are:

- Population: Office of National Statistics ward-level Mid-Year Population Estimates, 2012
- IMD: Department for Communities and Local Government, Indices of Deprivation, 2010.
- Household Income: CACI paycheck data.
- Child Poverty: HM Revenue and Customs, Child Poverty Statistics.
- Unemployment: Department for Work and Pensions/ Nomis, Worklessness Data. Department for Work and Pensions/ Nomis, Job Seekers Allowance Claimant Count.
- Housing: LCC Housing Strategy Units Lamp Team, HM Land Registry, House Prices Index
- Crime: LCC City-Safe Team / Merseyside Police.
- Heath: Public Health Liverpool
- Education: Department for Education and Skills /LCC Education Services.

Census data gathered in 2011 by the Office for National Statistics (ONS) is also available via Liverpool City Council's website. This can be used to track changes between the 2001 and 2011 census' to determine which statistics have changed most over the ten year period, and whether any changes can be attributed to the Mersey Basin Campaign or Liverpool's attempts at regeneration. All data are available at http://liverpool.gov.uk/council/key-statistics-and-data/ward-profiles/.

4.1.2. Environment Agency Data

The water quality data which has been examined throughout this thesis was obtained through the Environment Agency's website. The Environment Agency is a publically funded organisation which has acquired a key role in improving Britain's environment. In order to assess the Campaigns accomplishment in improving water quality to "fair" or higher by 2010, data was obtained in order to observe how successful the Campaign was. Map data is available from the Environment Agency website, but the maps available are interactive and are designed to be viewed on a website. 30 field sites

were selected at random using the interactive map and the data was extracted and processed through Microsoft Excel, and a series of tables and graphs were produced to better interpret the data for evaluation. The 30 field sites are located within the Mersey Basin Campaign's initial boundaries before the addition of the River Ribble catchment in 2004 (figure 7). The data collected by the Environment Agency was listed in four categories: Chemistry, Biology, Nitrates and Phosphates. Each field site was given a grade for each category to demonstrate its capacity in each class.

Of the categories which listed multiple grades, only the lowest grade was selected for this data set as the Environment Agency does in its own data analysis. Chemistry data for each site was averaged and the percentiles calculated; an overall grade was then assigned according to the lowest grade achieved in any three of the tests undertaken. Around 35 samples were taken along each stretch of river for each field site listed on the Environment Agency's website, as well as average and standard deviation values. Biological data was only collected on average every three years. The Environment Agency tested biological samples by comparing macroinvertebrates with the range of species expected to be found in an unpolluted river, taking into account natural changes such as geology and flow. Observed results were divided by the expected results to produce a probability grade percentage which reflected the grade allocated to the field site, however the Environment Agency does not list the standard deviation. For the majority of field sites only the average readings, number of samples and overall grade for each field site are listed. They do not specify how the data was collected or the range of the data sets. Phosphate data is similar; around 35 samples were collected from each site, but only the average values and overall grade for each field site are listed. The Environment Agency was established in 1996, and reliable records on these statistics go back as far as 1999/2000. Reliable chemistry data dates back to 2000 and biology, phosphates and nitrates data only go back as far as 2000.

All EA data are available by accessing: http://maps.environment-agency.gov.uk.

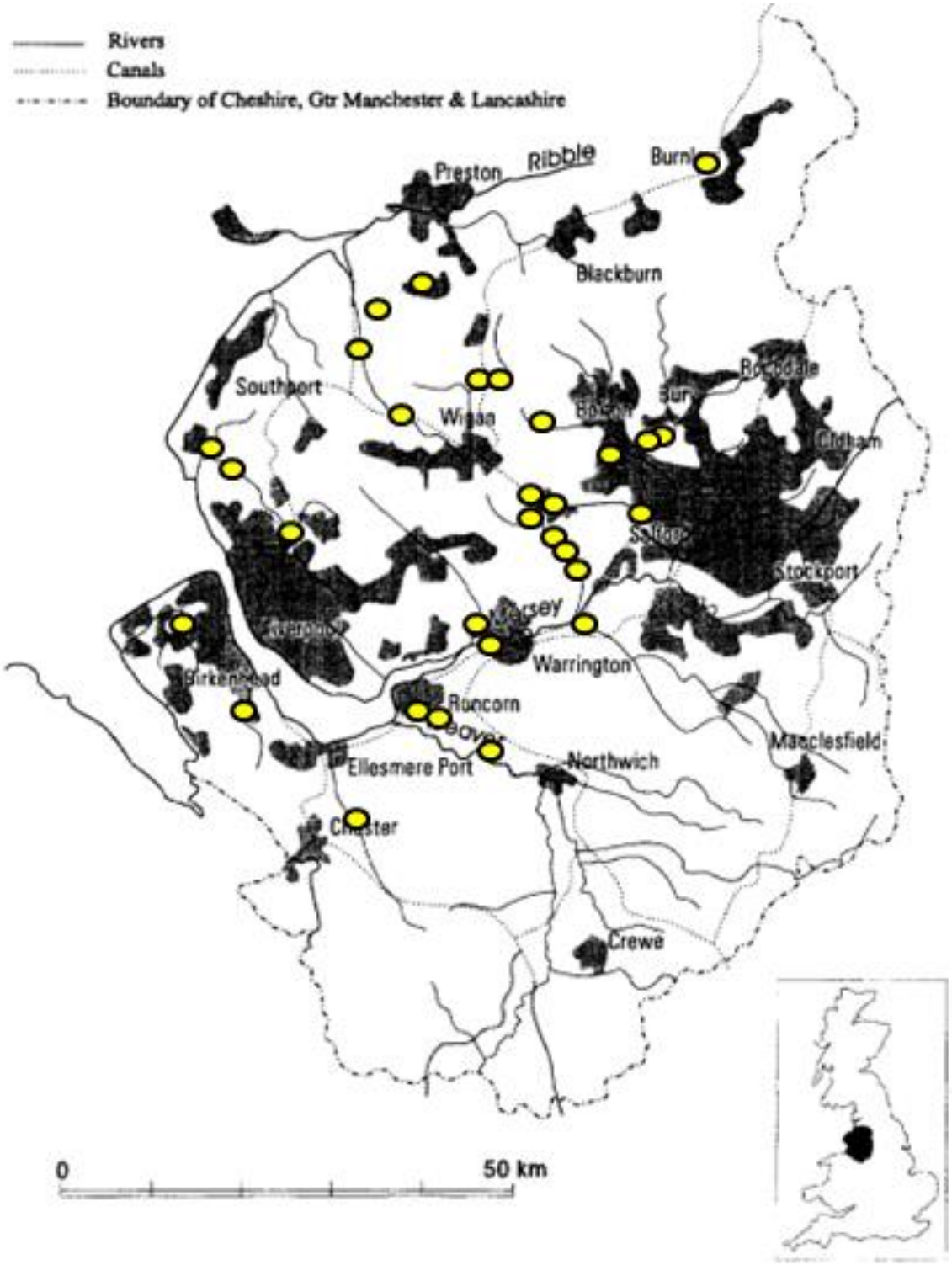


Figure 7: *The approximate locations for the 30 field sites within the geographical area of the Mersey Basin Campaign before the addition of the Ribble catchment in 2004 (edited from Wood et al., 1999)*

4.2 Evaluating Results

The analysis of the success of the Mersey Basin Campaign was conducted relative to two of the Mersey Basin Campaign's initial aims which were:

> To improve river quality to at least 'fair' standard by the year 2010 so that all rivers and streams are clean enough to support fish;
> To stimulate attractive waterside developments for business, recreation, housing, tourism and heritage.

The conclusions were drawn based on the data gathered for this research by the Environment Agency, Liverpool City Council, the Mersey Basin Campaign, the Lottery Heritage Fund and additional comprehensive literature analysis such as Jones (2000) and Wood *et al.* (1999). The Lottery Heritage Fund and alternative academic literature were used to assess the extent to which the Mersey Basin's Campaign had influenced any regeneration in Toxteth. This information was also used to evaluate how involved the Mersey Basin Campaign had been involved in the regeneration of Sefton Park and Liverpool's European Capital of Culture bid for 2008. The data supplied from the Environment Agency, the Mersey Basin Campaign's reports and from academic literature was used to assess how successfully the Mersey Basin Campaign has been in fulfilling its aims to improve water quality across the Mersey catchment.

Data supplied by the Environment Agency for 2009 was categorised, and the total values for each category shown by a series of bar charts to summarise aspects of water quality at the end of the Campaign. This provides the most efficient form of data observation and analysis as the results can be clearly shown despite the complexities behind the initial data collection. Line graphs for data sets regarding water quality were categorised into chemistry, biology, nitrates and phosphate data to analyse changes in these variables from 2000 to 2009 to determine changes over time.

Data gathered by Liverpool City Council was processed in Excel and used to create the following graphs: household income, unemployment, population change, deprivation, child poverty rates, GCSE grades and crime statistics. In addition to this, housing data was also collected in order to assess Toxteth's housing and education situation and whether this could be attributed to any other statistics.

5. Results

5.1 Water Quality within the Mersey Catchment

For twenty years the Environment Agency (EA) used a General Quality Assessment (GQA) scheme to assess river water quality by looking at chemistry, biology and nutrients. The European Water Framework Directive (WFD) introduced a more sophisticated method looking at over 30 measures grouped into ecological status. This included biology as well as 'elements' like phosphorus, pH and chemical status (Environment Agency). The following data was collected under the GQA.

The categories Chemistry, Biology, Nitrates and Phosphates are graded on a series of criteria listed by the Environment Agency:

- Chemistry – Grade A is "very good" and "these rivers have natural ecosystems and make very good salmaniod and cyprinid fisheries. They may be used for any type of water abstraction including potable supply. Grade B ("good") would typically have salmonid fisheries, cyprinid fisheries and ecosystems at or close to natural. Grade F is categorised as "bad" and these rivers have severely restricted ecosystems and are very polluted.
- Biology – Grade A is also classified as "very good". The biology is similar to that of what you would expect in an unpolluted river. Grade B is classed as 'good' - The biology shows minor differences from Grade A and falls short expectations for an unpolluted river. There may be a small reduction in the number of families that are sensitive to pollution, and a moderate increase in the number of individuals in the families that tolerate pollution like worms and midges, indicating signs of organic pollution. Grade F is "bad" and the biology is limited to a small number of species which are very tolerant of pollution.
- Nitrates – On a scale of 1 to 6 (very low levels to very high levels)
- Phosphates - On a scale of 1 to 6 (very low levels to very high levels) The Environment Agency stated that in 2006, 50% of rivers had high concentrations of phosphate (greater than 0.1mg/l), compared with 54% in 2000 and 64% in 1990 (Indicator: River phosphate). In 2006, 28% of rivers had high concentrations of nitrate (greater than 30mg/l), compared with 32% in 2000 and 30% in 1995. The results for the 30 sites selected at random and the results are as follows;

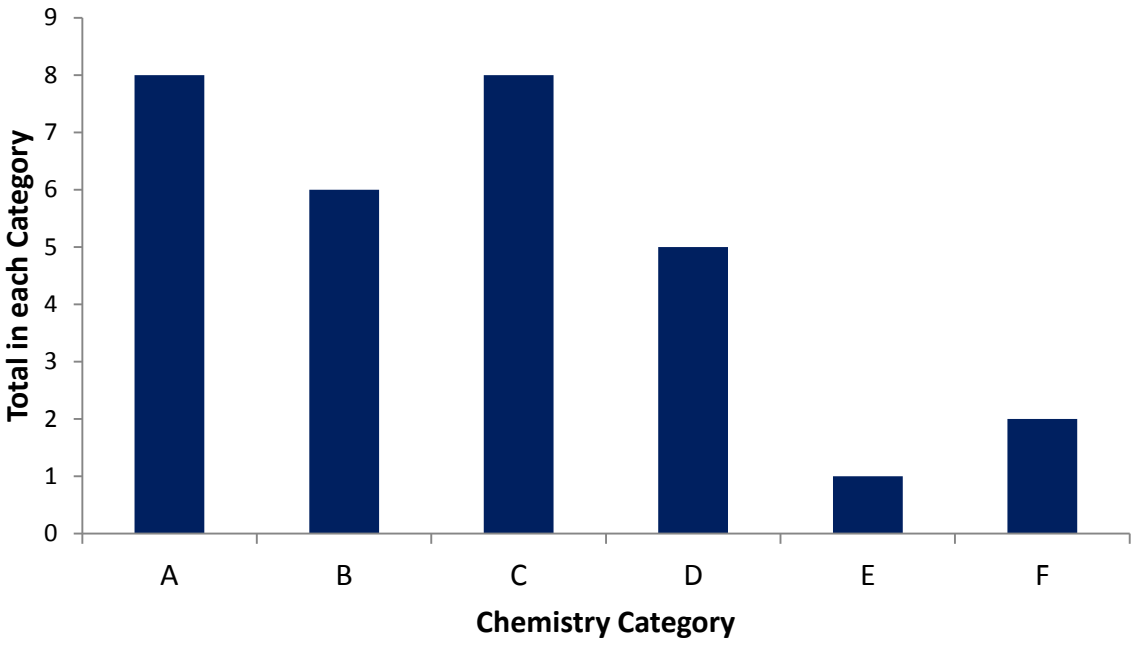


Figure 8: Chemistry Data for 30 randomly selected sites within the original Mersey Catchment Area (Environment Agency, 2009)

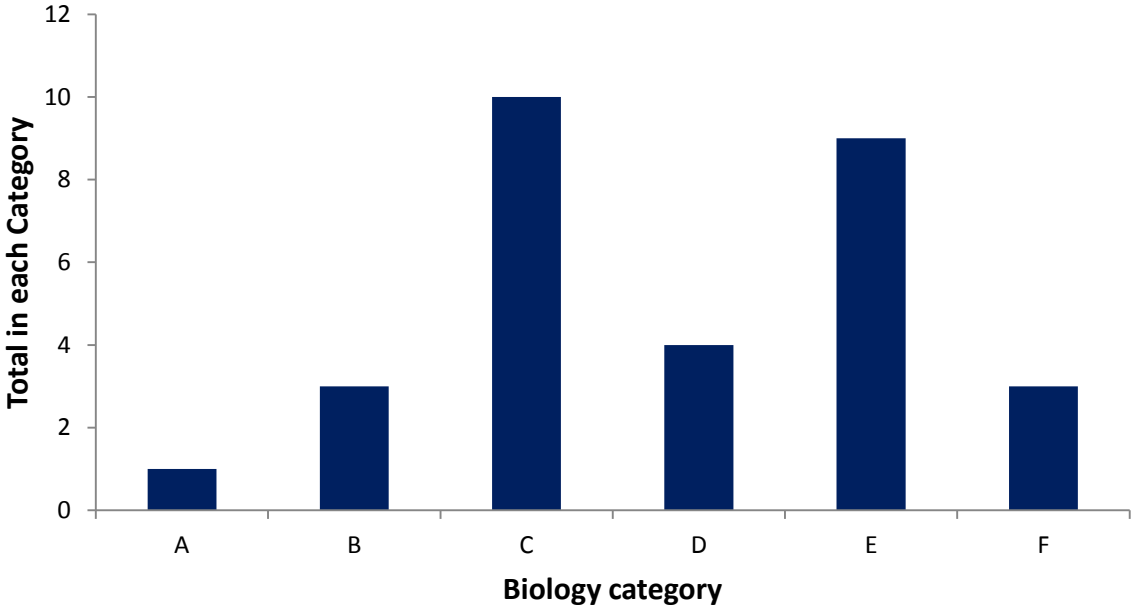


Figure 9: Biology data for 30 randomly selected sites within the original Mersey Catchment Area (Environment Agency, 2009)

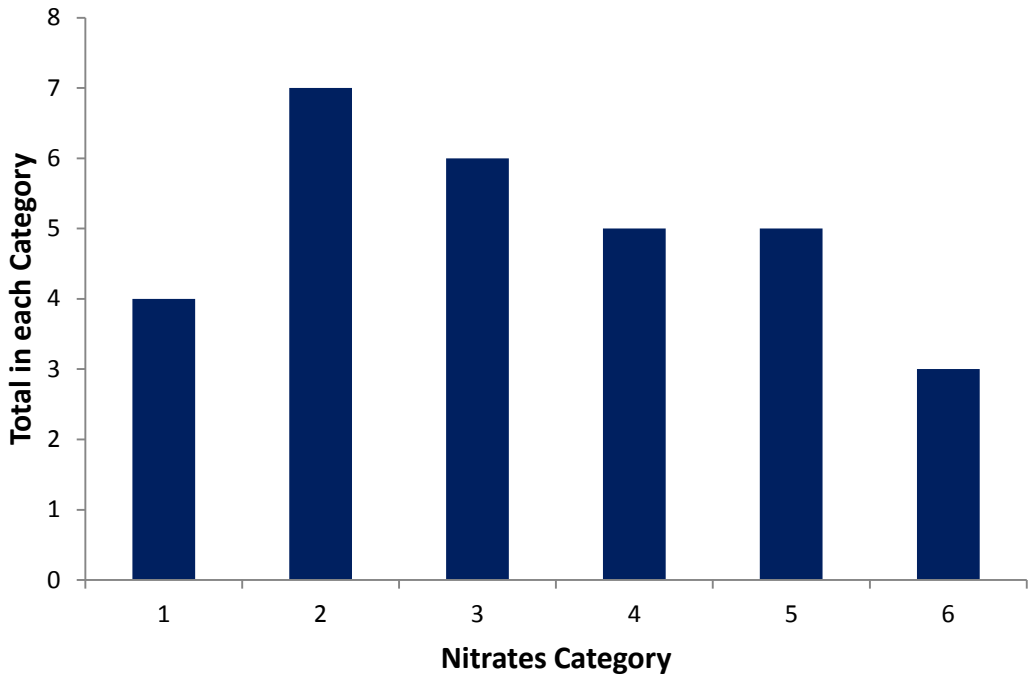


Figure 10: Nitrates data for 30 randomly selected sites within the original Mersey Catchment Area (Environment Agency, 2009)

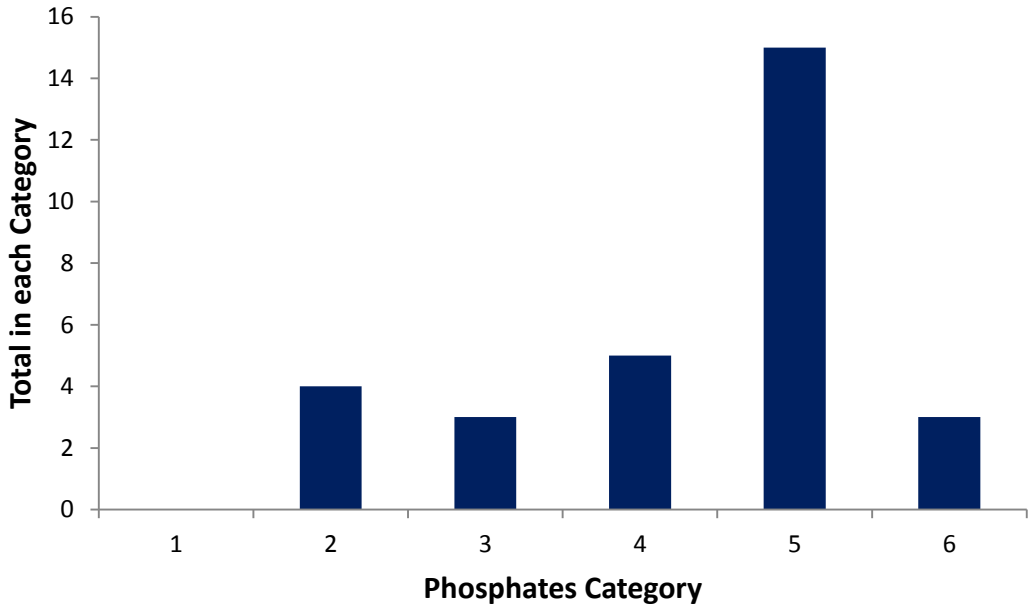


Figure 11: Phosphates data for 30 randomly selected sites within the original Mersey Catchment Area (Environment Agency, 2009)

Figures 8-11 summarise the chemistry, biology, nitrates and phosphates data for 2009, the year before the Campaign finished. The following data is a summary of the final ten years of the Campaign and uses average yearly values for each category. The graphs produced show whether there have been year by year improvements in any of the categories.

Biology and chemistry data were initially categorised from A to F as this is the system used by the Environment Agency, with A being the best category and F being the worst. In order to convert this to data which was suitable to plot on a graph, the values had to be changed; A=1, B=2, C=3, D=4, E=5 and F=6. If the Mersey Basin Campaign had been improving water quality every year, the graphs should be a line of increasingly lower value as time progresses.

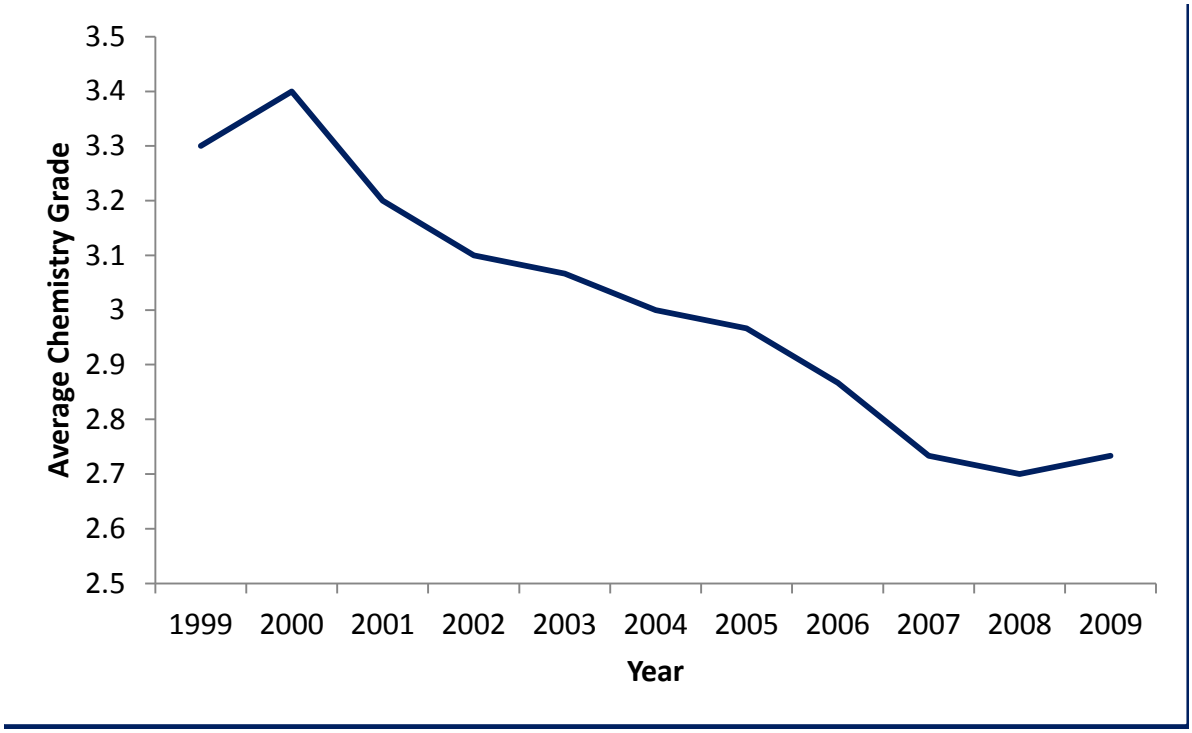


Figure 12: Average chemistry data for 30 randomly selected field sites from 1999-2009

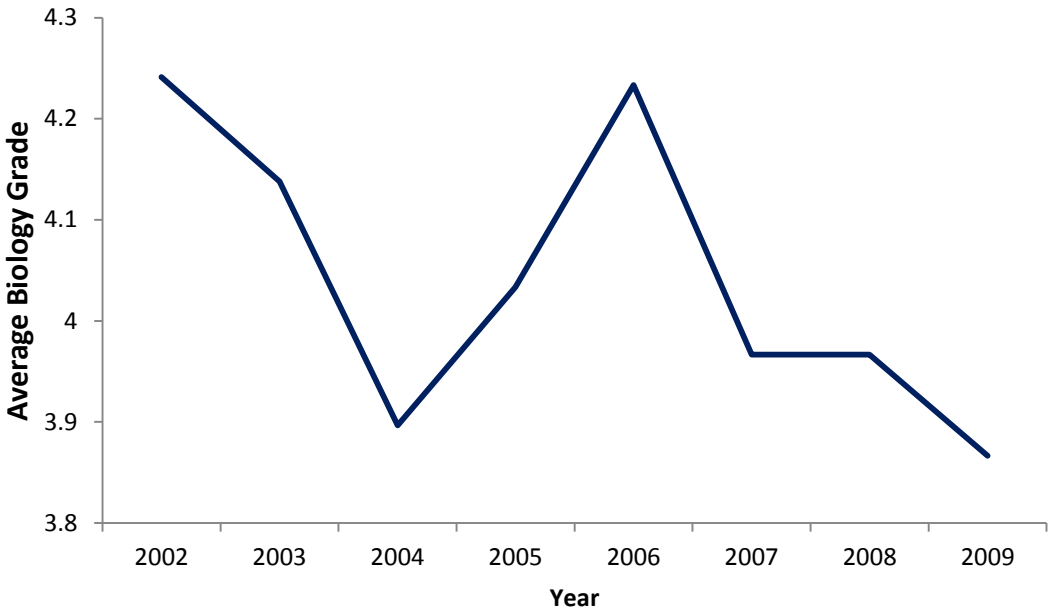


Figure 13: Average Biology grade for 30 randomly selected field sites from 2002-2009

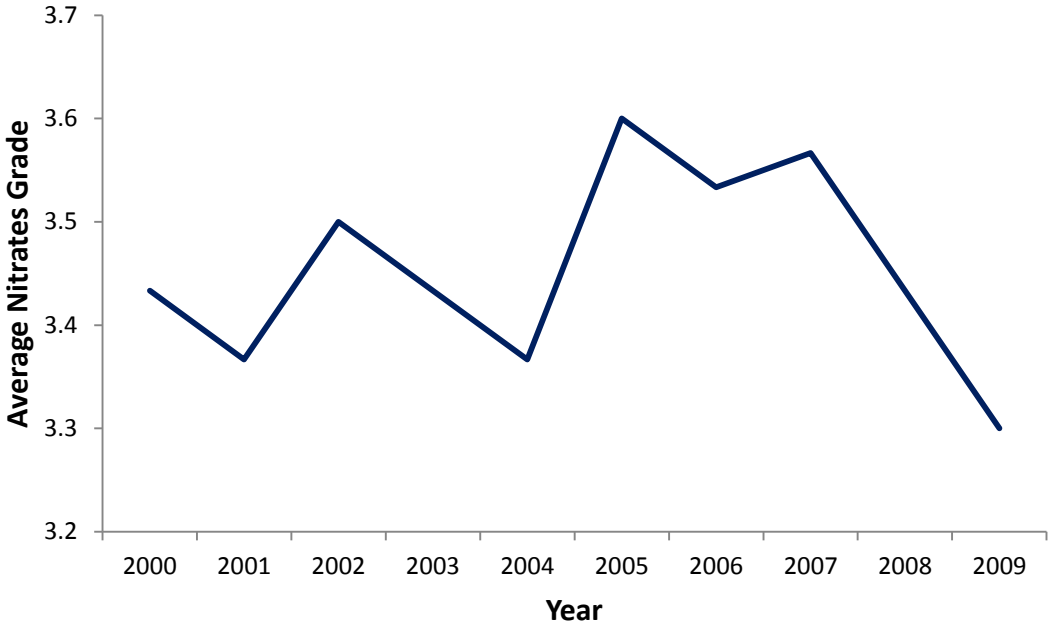


Figure 14: Average Nitrates data for 30 randomly selected field sites from 2000-2009

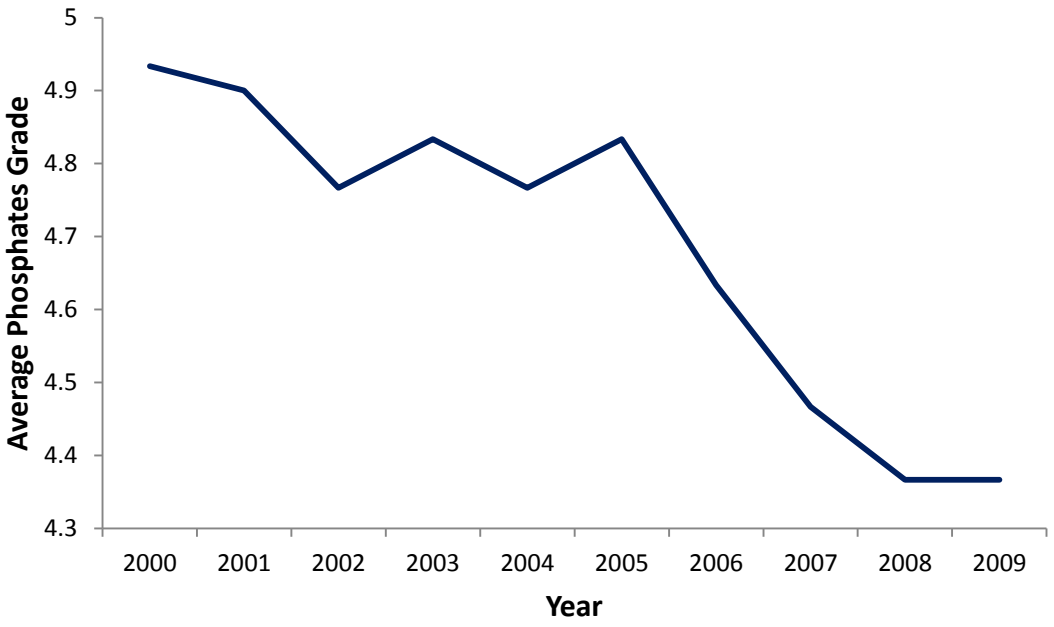


Figure 15: Average Phosphates grade for 30 randomly selected field sites from 2000-2009

Figures 12 and 15 demonstrate general trends of increasing water quality in their categories towards the end of the Mersey Basin Campaign, however figure 14 demonstrates that some results, in this case nitrates, are subject to large fluctuations. This may indicate that pollution into the Mersey Catchment is not as strict as is necessary to improve water quality at a faster rate. The data also helps highlight the greatest sources of pollution which may have resulted in many of the field sites missing their targets for "good" or "fair" status.

There are several biological statistics missing as well as all data from 2001, therefore the data for figure 13 starts in 2002 instead of 2000. The Environment Agency also states that biological data is only collected on average every three years whereas chemistry, nitrates and phosphates data was collected 12 times a year, and an average of 35 samples were taken each time. Nevertheless biological data has been examined and used in this research to help demonstrate whether the general trend is that water quality has been improving over the final decade of the Mersey Basin Campaign, and whether the catchment is being adequately monitored.

5.2 Statistics for Toxteth

Average household income is one of the most important statistics throughout the research as there are distinct correlations between income and many of the other statistics, and can therefore be connected to many of the graphs produced throughout this thesis. Comparing average household incomes, Princes Park is several thousand pounds below the National Average (Figure 16). Princes Park's average household income was just £24,300 compared to £32,500 for Riverside. Liverpool's average was £30,100 and the National Average household income was £36,400.

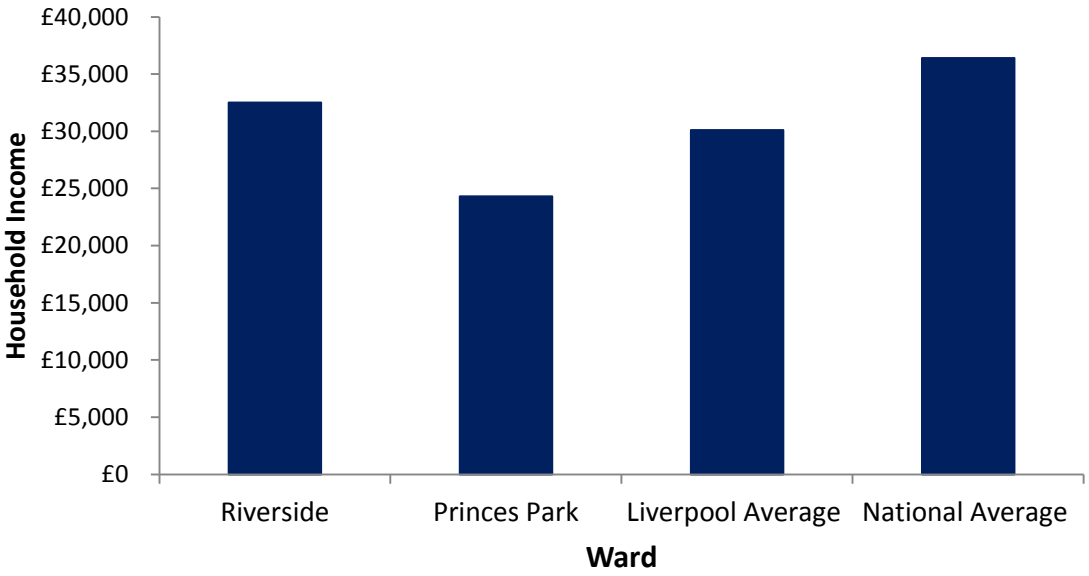


Figure 16: Average Household incomes in 2013

Toxteth has historically been one of Liverpool's hardest hit areas after the deindustrialisation of Britain, and was hit further due to factory closures in the latter half of the 20th century. Unemployment levels rocketed which was one of the factors which led to the Toxteth Riots in 1981 (Meegan (2003). Figure 17 shows that whilst unemployment still remains very high in Princes Park, Riverside has statistics which are lower than Liverpool's average. The ward of Princes Park appears to be statistically the worst area in this study in terms of its economy. Low household incomes are attributed to two key factors; poorly paid jobs and high rates of unemployment. Riverside has an unemployment rate of 16.7% compared to 28% for Princes Park. Household Income and Percentage of Unemployment are related; as a rule the higher the levels of unemployment, the lower the levels of household income due to fewer working incomes per household.

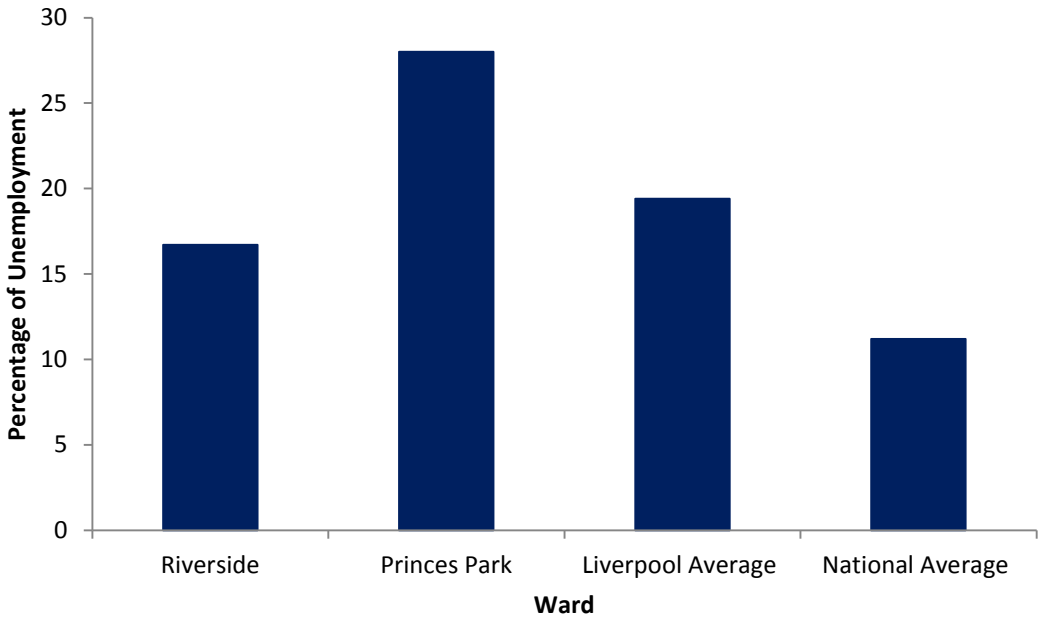


Figure 17: Percentages of unemployment in each ward compared to Liverpool's and the national averages in 2013

'Deprivation' implies a standard of living or quality of life below that of the majority of a particular society to the extent that it involves hardship, inadequate access to resources and underprivilege (Herbert, 1985). It compares less to an individual and more to an average threshold. It is a complex term to describe as different areas have different standards of living, meaning devising a statistic for the National Average level of deprivation is complex. It could be argued that deprivation exists in all levels of society – the boarding school child with the insufficient family life may be seen as in a deprived state compared to other people in that environment (Herbert, 1985). National Average statistics for Deprivation are unavailable, however Riverside had deprivation percentages of 38.6%, Princes Park had levels of 93.7% and Liverpool's Average was 49.6% (Figure 18). Average household income and deprivation appear to be related; the lower the average household income of the ward, the higher the percentage of deprivation. This is to be expected as household income is one of the factors in calculating deprivation. Additionally households with less disposable income have less money after buying necessities to buy products to improve their standard of living, for example purchasing family cars.

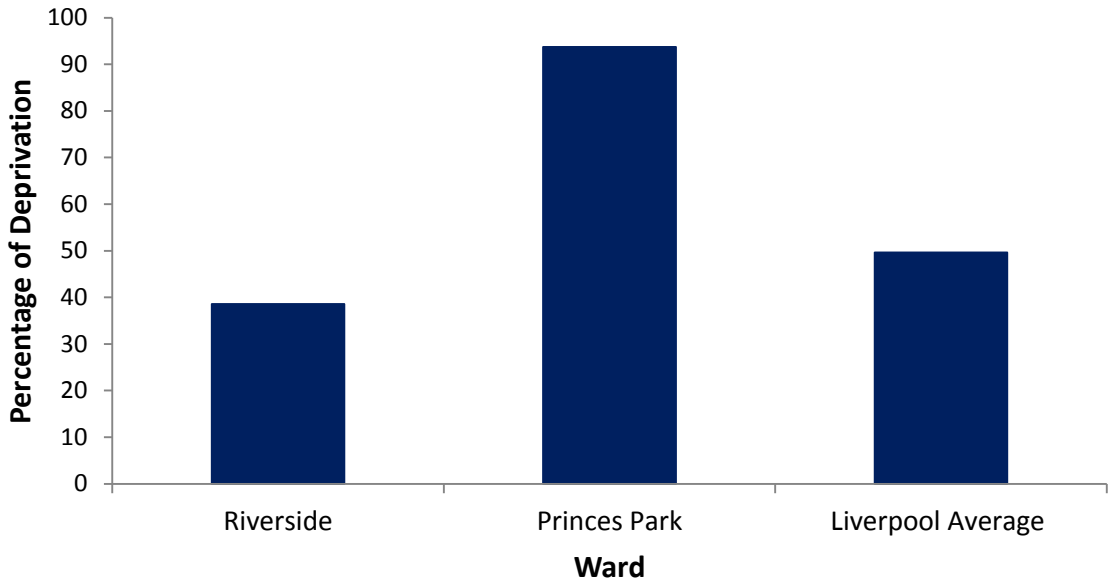


Figure 18: The percentages of deprivation in each ward compared to Liverpool's average in 2013

The definition of Child Poverty in the UK has been tampered with over the past few years, and there are still criticisms regarding its current definition. At the moment children are said to be in poverty if they live in a household with an income less than 60% of the National Average (Brewer, October 2011). Child Poverty statistics are subject to fluctuations and correlate with periods of both wealth and austerity. However all changes in child poverty statistics will be relative to one another; A recession will affect the statistics, although the additional effects of a recession may hit some wards more than others where employers are hit by recession.

The household income statistics were obtained through CACI paycheck data. The Paycheck dataset is a modelled index of gross household income which has been developed by the company CACI. The data take into account investments, welfare support and income supplements to provide a detailed assessment of income broken down by employment, investments and benefits. Unfortunately the data used by Liverpool City Council does not dissect household income statistics in this level of depth, therefore it is not possible to analyse the percentage of children who are in child poverty and how this correlates to households on welfare support and income supplements.

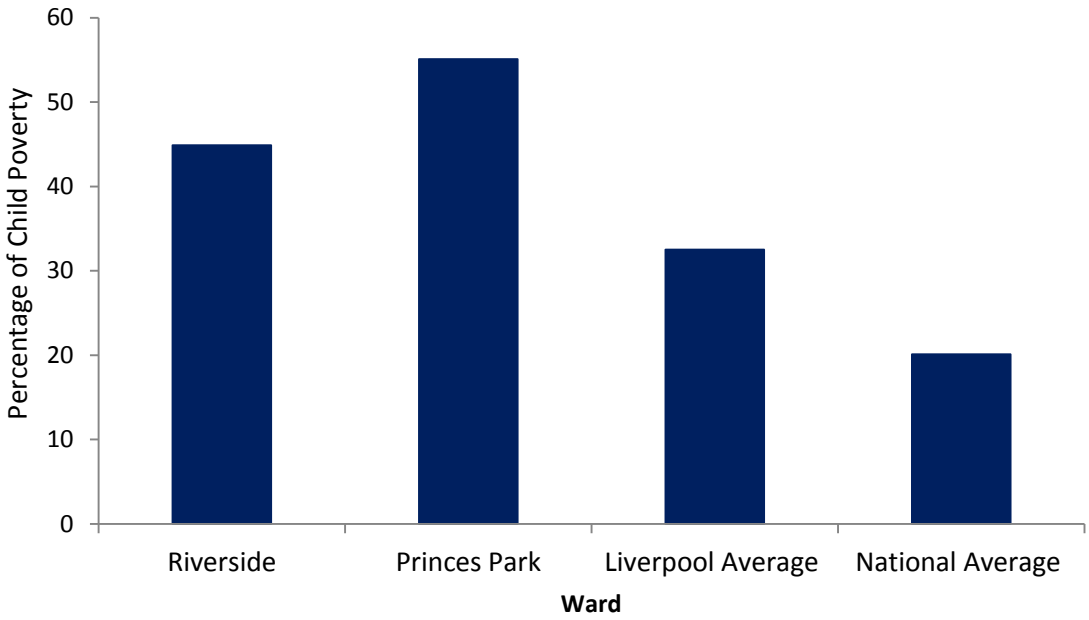


Figure 19: Percentages of Child Poverty in 2013

Figure 19 shows Child Poverty is several times higher in areas of Liverpool compared to the National Average statistics. Riverside has a percentage of child poverty at 44.9% compared to 55.1% in Princes Park. Liverpool's average is 32.5% and the National Average is 20.1%. Princes Park has almost three times the levels of child poverty compared to the National Average. This is predictable due to higher rates of unemployment, lower household incomes and higher levels of deprivation.

Higher levels of child poverty could potentially have an impact on the percentage of school children achieving 5 A* to C's at GCSE level. Higher poverty levels mean fewer children going to fee-paying schools which statistically produce better GCSE results, and children who are in part-time employment out of school hours may have less time to pursue their studies at home. Figure 20 shows Riverside had a GCSE percentage of 38% compared to 36.4% in Princes Park. Liverpool's average was 56.6% compared to the national average of 59.2%. The data does appear to suggest that child poverty and GCSE grades may be loosely related, however the results do not show as direct a correlation compared to the connection between unemployment and household income. Poor GCSE results are also an indication of a series of factors such as education cuts and poor schools, and can spark a spiral of decline if school leavers

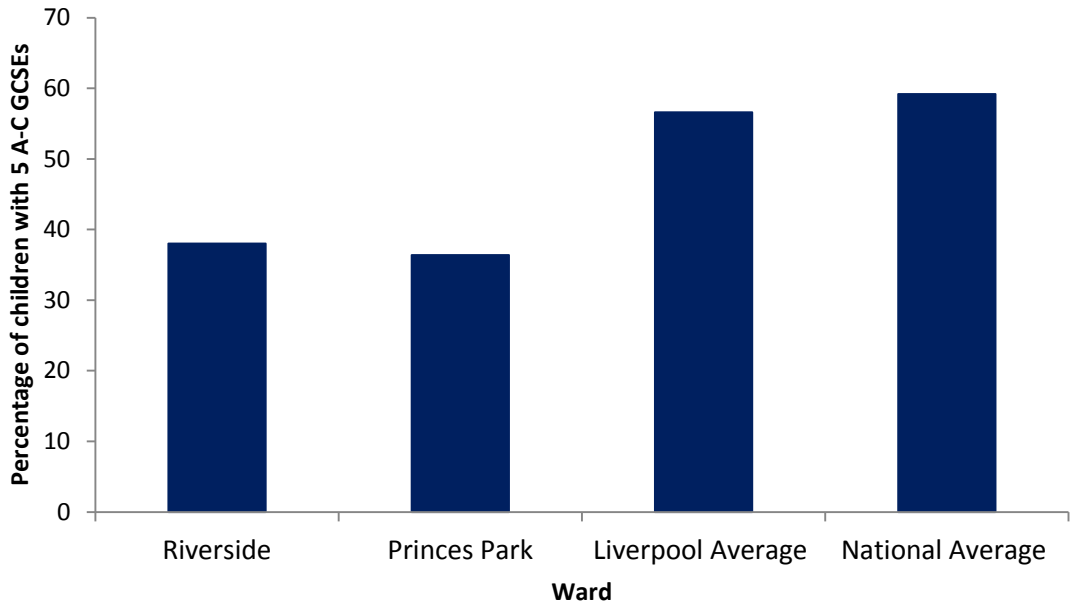


Figure 20: Percentage of children leaving high school with 5 GCSE's graded A to C in 2013*

are not encouraged to improve their career prospects after GCSE level. Poor GCSE's lead to poor job prospects unless more apprenticeships are made available to school leavers who are not strong academically, or children are encouraged to a greater extent through their A-Levels to improve their chances of a university education.

The success of the Mersey Basin Campaign, whilst hailed as a tremendous success by many academic papers and media, is not as clear-cut as it has been perceived. At first glance, Toxteth is still one of the most deprived areas in Liverpool and whilst local regeneration projects have been undertaken, they do not appear to have had much of an impact.

The percentage of population change in Riverside and Princes Park is several times higher than the National Average with Riverside having percentage changes of 38.3%, Princes Park at 23.2%, Liverpool's average at 5.8% and 7.3% for the national average (Figure 21). However the high percentages of population change can be attributed partly to the nature of the people living there. Liverpool's universities ensure than several thousand students need to look for accommodation in Liverpool every year, and Toxteth being a cheap place to live ensures it remains a popular student residential area and will do so for the foreseeable future. University students are often regarded by local residents as somewhat of a negative attribute due to their nature of increasing

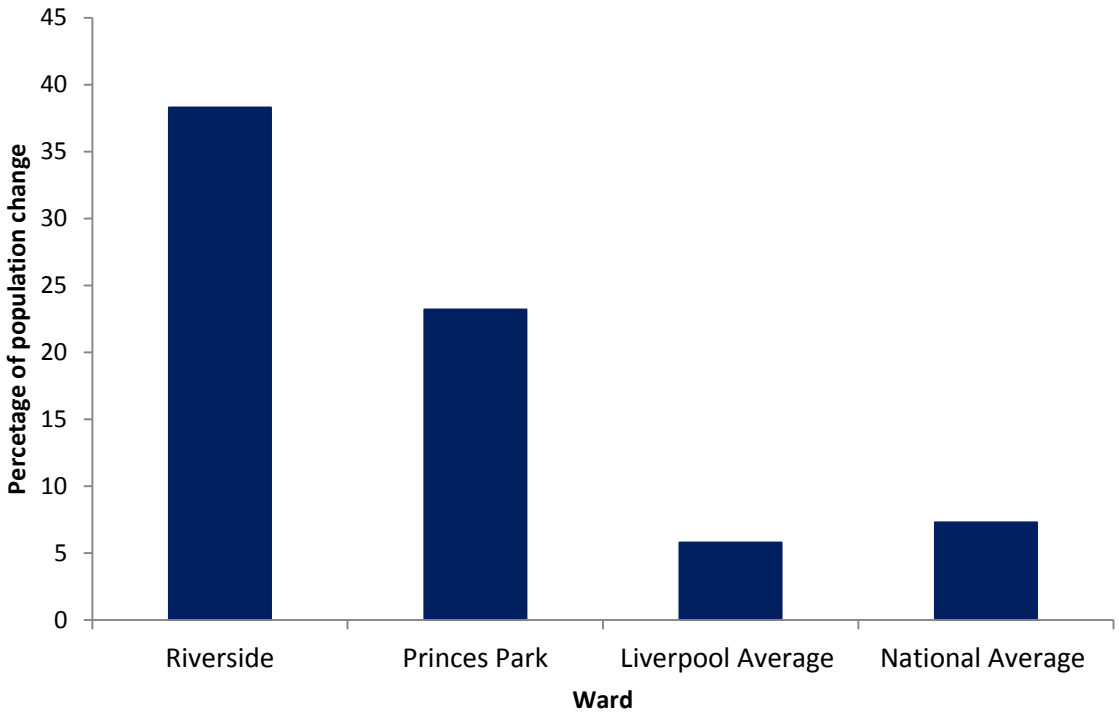


Figure 21: Percentage of Population Change in 2013

rent prices due to increased competition for housing. However most students have a regular income and are invaluable to the local economy. Due to the cheap housing in Toxteth, it is likely that Toxteth would decline further without the support of its student population.

High crime rates are one of the factors which determine how an area is perceived by people living outside the area. Toxteth has struggled to remove its negative reputation which occurred due to the 1981 Toxteth Riots, and high crime rates can deter people moving to an area. Regeneration usually aims to improve people's perceptions of an area, but does not always lead to reductions in crime. Crime rates within Riverside are 246.1 per 1000, compared with 98.9 for Princes Park (figure 22). The Liverpool Average is 91.9 and the National Average was 66.4 per 1000. The anomaly in this data is that Riverside has a crime rate around two and a half times higher than that of the next highest value. Princes Park with its high unemployment, lower household income and high deprivation should be the obvious candidate for the highest levels of crime, however Riverside which is more affluent experiences far greater levels.

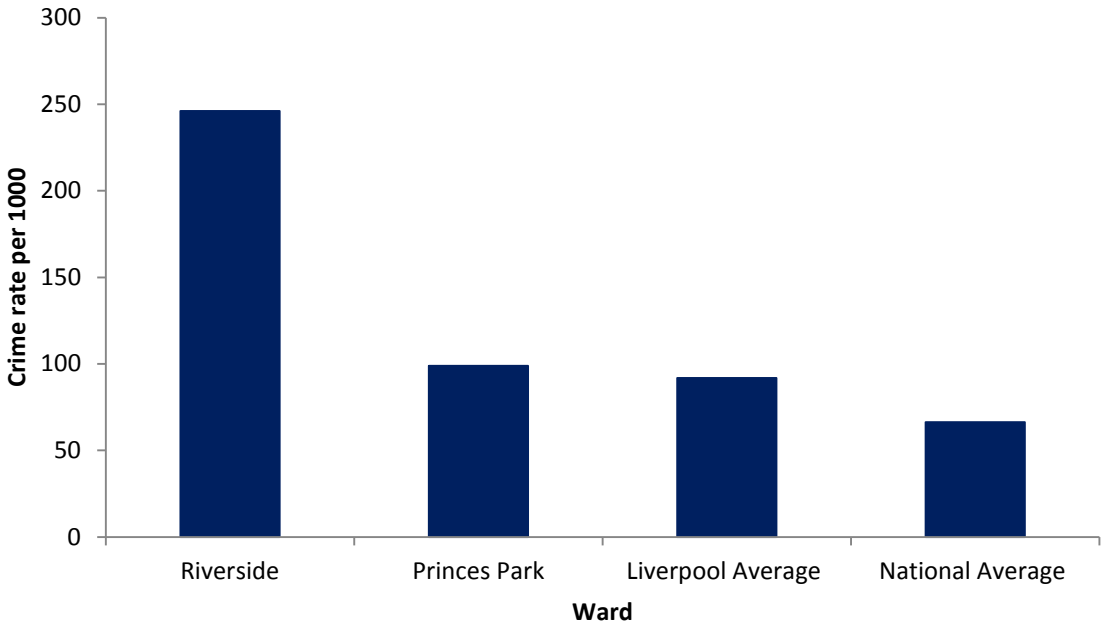


Figure 22: Crime Rates in 2013

5.3 Housing in Toxteth

Council tax bands can be used to identify the type of housing in an area based on its value. This partially correlates to population changes, unemployment and household income. In Princes Park (Figure 23) 88.7% of households were in band A, 6.2% in band B, and only 3.7% were in band C or higher. In comparison, the percentage of households in the Riverside ward in band A is 55.8%, 13.1% in band B and 30.9% in band C or higher (Figure 24).

The volume of small, low quality housing is not necessarily a reflection of how poor an area is; the reality in Toxteth is complicated. The volume of small, cheaper homes is popular with students and people migrating to Liverpool, as well as people on low incomes in poorly paid jobs as the rates of tax are lower. High volumes of homes in low council tax bands also draw people in who are starting at the bottom of the property ladder. Princes Park and Riverside have very high levels of low value properties in council tax bands A and B, but this is not necessarily a bad thing. This ensures that students will not be priced out of Toxteth and the area will not lose a valuable asset.

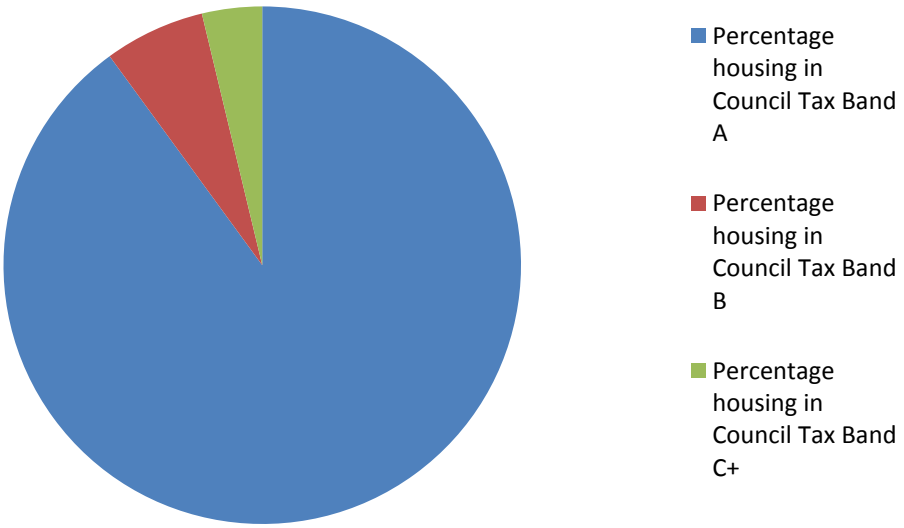


Figure 23: Percentage of households in Princes Park in council tax bands, A, B and C or higher in 2013

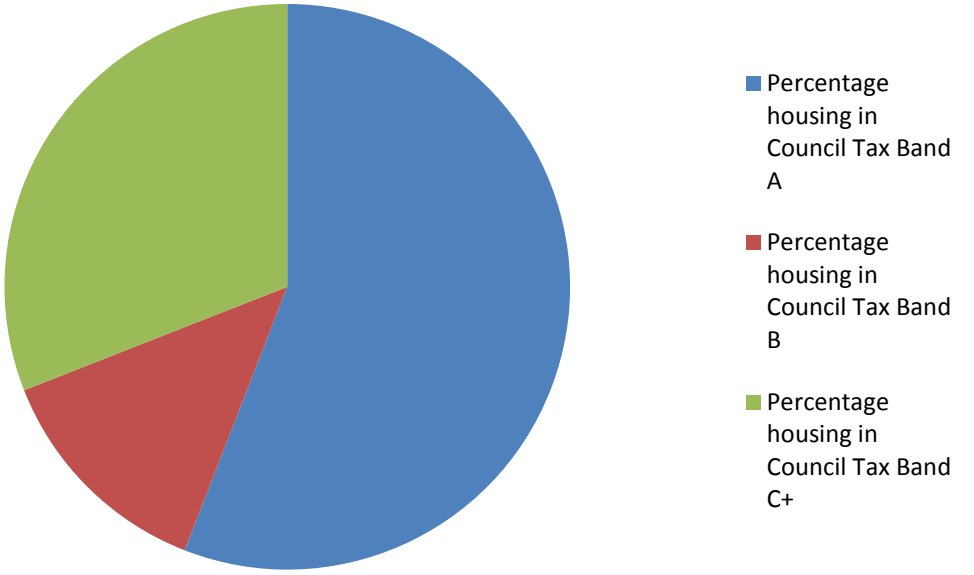


Figure 24: Percentage of Households in Riverside in council tax bands A, B, and C or higher in 2013

Toxteth has a housing crisis which will be discussed further; there are rows of derelict houses which were initially due for demolition, but plans to remove them have since been terminated. Figures 23 and 24 only partially describe the nature of housing in Toxteth.

6 Discussion

6.1 Water Quality in the Mersey Catchment

The data gathered by the Environment Agency and processed for this research highlights potential sources of pollution which need to be monitored more frequently. These sources of pollution are partially responsible for the Mersey Basin Campaign's failure to meets its targets of improving all water quality to good or higher by 2010.

6.1.1 2009 Data

Figures 8-11 summarise the Environment Agency data from 2009, the year before the termination of the MBC, and the results are varied. The water chemistry data is the category which demonstrates the trend which the MBC was aiming for; 8 field sites are graded A, 6 grade B, 8 grade C, 5 grade D, 1 grade E and 2 graded F. Almost half of field sites were in the two best categories for water chemistry.

Biological data was only collected every three years by the Environment Agency and could be regarded as the most unreliable data set of the four categories. In 2009 only one field sites was rated grade A, 3 in grade B, 10 in grade C, 4 in grade D, 9 in grade E and 3 grade F.

The nitrates graph (figure 10) shows that the majority of field site grades are quite spread out, unlike the chemistry data set. 4 sites were in grade 1, 7 in grade 2, 6 in grade 3, 5 in grade 4, 5 in grade 5 and 3 in grade 6.

Figure 11 shows that phosphates grades are poor in comparison to the chemistry data set. None of the field sites are in the top category, 4 are in category 2, 3 are in grade 3, 5 in grade 4, 15 in grade 5 and 3 in grade 6.

These results show the categories where the MBC has failed to meet its targets and where potential sources of pollution may have been entering the River Mersey and its tributaries. The water quality data from 1999 to 2009 also shows where the MBC has failed to consistently improve water quality in each of its categories and why these results for 2009 fall short of the MBC's initial aims of achieving "good" or higher status across all water bodies in the Mersey Catchment.

6.1.2 1999-2009 Data

Examining the chemistry data from figure 12, water chemistry has improved in all years except one. This data set is the most reliable of all the data provided by the Environment Agency. All data was consistent, and chemistry data was made up of two or three readings and at least 35 samples. This graph shows that almost every year from 2000 to 2009, water chemistry was improving.

Biological ranking shows an improving trend between 2002 and 2009 (figure 13), however the statistics are subject to large fluctuations. This may be due to inconsistencies in the data rather than large changes in the biological capacity of rivers in the Mersey Catchment. As biology data was only collected every three years, the data collected in one year may have been used for the subsequent two years on the same site: the Environment Agency does not state accurate biological data. In many of the data sets there were no average figures, sample numbers or standard deviation values, suggesting that there may have years in which all the necessary data was not collected. This would affect the appearance of the graph; however the general trend of improving biological capacity is evident.

Figure 14 shows that nitrates content across thirty field sites has also been subject to fluctuations, although the 2009 statistics are the lowest on the graph. Initially this shows that The Mersey Basin Campaign may have been successful in reducing nitrates levels in the Mersey catchment to a ten year low, however the fact that the data shows large fluctuations in nitrates content across the field sites means that it is difficult to say what data which may have been collected from 2010 onwards would show. Additionally the average ranking of the 30 field sites is only fractionally lower in 2009 than it was in 2000. Figure 14 also demonstrates a lack of discipline from the Environment Agency and the Mersey Basin Campaign in reducing the volume of nitrates entering the Mersey. As the MBC aimed to improve standards of water quality from 1985 to 2010, the fluctuations in nitrate volumes in the Mersey is surprising.

Observing phosphates data (figure 15), the data shows a strong correlation with improving quality towards the end of the Campaign, particularly in the last five years. There have only been two years in the data set where the average value of the 30 field sites ranking has worsened. The average value for phosphates ranking fell from 4.93 in 2000 to 4.37 in 2009.

6.1.3 Potential Sources of Pollution in the Mersey Catchment

Water chemistry (figure 12) has not fluctuated in the same way as nitrates or phosphate content in figures 14 and 15. Therefore there may be sources of nitrates and phosphates entering rivers within the catchment which both the MBC and the Environment Agency did not have strict control over.

Nitrate and phosphate levels affect the ability of plants and organisms to grow, as well as the diversity of aquatic life that can be supported. Nutrient levels fluctuate naturally due to geographical location owing to factors such as geology, topography, climate, vegetation, and flow rate. Wakida and Lerner (2005) stated that the difference between rural and urban nitrate concentrations is often small, due to the non-agricultural sources of nitrogen that are concentrated in cities. The Mersey Catchment is a heavily urbanised catchment and the Mersey flows through two conurbations; Liverpool and Manchester. Both agricultural and non-agricultural sources of nitrogen can be concentrated in sample sites due to population concentrations, resulting in large fluctuations despite efforts by the Environment Agency to reduce levels within the Mersey catchment. The United States Environmental Protection Agency (2012) lists the following as common sources of nitrates: wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, runoff from animal manure storage areas, and industrial discharges that contain corrosion inhibitors. Wastewater treatment plants are subject to testing from the Environment Agency, however the other factors which can influence nitrate levels in the Mersey are harder to monitor.

One of the most common sources of phosphates results from runoff from urban and agricultural land (Mc Callister and Logan, 1978) and wastewater treatment plants (Puckett, 1995), however phosphorus occurs naturally in rocks and mineral deposits and can get into watercourses naturally. Figure 15 shows that between 2000 and 2005, the general trend was that phosphate levels were reducing; however the graph shows small fluctuations of phosphate content across the field sites. There is also a sharp decrease in average phosphate grade across the thirty field sites between 2005 and 2009; this demonstrates that while phosphate levels had been fluctuation over the final ten years of the MBC, the overall trend was that average phosphate content was improving.

6.1.4 Evaluating Improvements in Water Quality in the Mersey Catchment

Academic papers on the Mersey Basin Campaign started to be published around 1995, ten years into the MBC. A few more were published between 10 and 15 years into the project which marked the halfway point of the 25 year scheme. Many of these papers agreed that the project was very successful despite the fact that it was unfinished.

Jones's 2000 paper is one of the most referenced papers regarding the Mersey Basin Campaign, and the MBC has referenced his work in their own self-published reports. However Jones reported that a lack of previous literature and data on the Mersey Catchment hindered his research; Jones (2000) found that water quality data until the 1960s was sparse, as was any information relating to the biological status of the estuary. While records of fish stock levels may have been made since the 1960's, they are hard to access online. Data on fish stocks is available from the mid-nineties onwards, however they are very vague. A paper by Sharp and Maclean published in 2010 found "Acoustic surveys, also in 2002, covered 150km of 20 rivers but results from only 70km were deemed reliable," demonstrating that what little data is available is not sufficient enough to use in an academic study to assess how successful improving water quality has been. Jones (2000) and Wood *et al.* (1999) highlighted the success of the Mersey Basin Campaign in improving water quality; however the water quality data from the Environment Agency is not sufficient enough to draw significant conclusions for the time period between 1985 and 2000.

Figure 25 taken from a Mersey Basin Campaign report demonstrates that the length of river which is classified as good or fair has increased by around 150% between 1990 and 2006. However the graph also shows stagnation in improving river quality from the year 2000 onwards. The total length of river which does not meet Water Framework Directive standards remains constant, primarily as a result of rivers being so close to the main urban areas within the Mersey Catchment still receiving some effluent disposal. Additionally the tidal nature of the estuary means it is more susceptible to coastal pollution. Whilst the first year of the Campaign saw over 1000km of river length within the catchment unclassified, data obtained later than 1997 is more consistent. Figure 25 also shows the level of monitoring grew significantly between 1990 and 1996, however the literature and lack of data available online suggests that rivers within the Mersey Catchment were not being monitored as

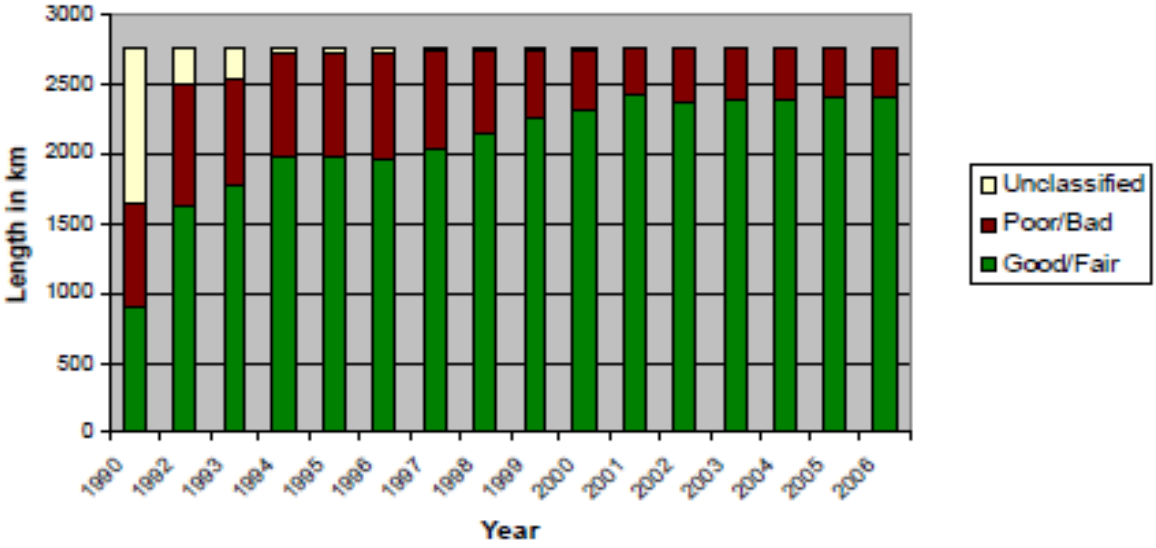


Figure 25: Length in Kilometres of rivers in the Mersey Catchment which fall into each classification category (Mersey Basin Campaign report, N.D.)

frequently as possible between this time frame (Jones, 2000). Figure 25 shows improvements in the length of watercourses in the Mersey catchment being rated 'good' or higher stagnated between 2001 and 2006; however the remaining 'poor/bad' rivers will be primarily located in the largest urban areas.

The Mersey Basin Campaigns aim to improve water quality within all rivers in the Mersey Catchment to 'fair' or higher by 2010 was not successful. Whilst water quality has improved dramatically there is still a long way to go in improving water quality in order to support salmon within the Mersey and its tributaries. Improvements in water quality have without a doubt been the most successful aspect of the Mersey Basin Campaign; however the project has fallen short of its targets and also fails to comply with the standards set by the European Union Water Framework Directive across the whole of the catchment.

Jones (2000) stated that the lack of available data from consistent monitoring proved an issue for their research, and it has provided problems throughout this one. The Mersey Basin Campaign fails to outline some of the most basic work which was undertaken within the Mersey catchment. Additionally Jones (2000) paper simply regards the project as "unequivocal evidence that the water quality of the river and the biology of the system have improved significantly and will continue to do so as further planned alleviation schemes are completed." Even academic literature is

relatively vague in summarising the results of the Campaign, despite it being one of the biggest water improvement projects in the UK.

As a result of the Mersey Basin Campaign's efforts, the BBC reported in 2011 that the Mersey is now the cleanest it has been since the early 1900s, and that scientists had recorded oxygen levels of over 60% after a 20-year clean-up operation. In 2002 the Environment Agency captured and returned 26 salmon at a fish trap at Woolston Weir near Warrington, and other varieties of fish, including brown trout, sea trout, lamprey, dace and cod are also now frequently caught by anglers (BBC, 2011). Otter paw prints were also spotted by the Mersey in 2011 by Forestry Commission rangers, providing further evidence for the success of the MBC's water quality improvements. Otters became a protected species under the Conservation of Wild Creatures and Wild Plants Act of 1978 due to their decline, and will only live in very clean water (Mason & Macdonald (2009) p135).

Jones's statement in his 2000 paper that there was a lack of available data, as well as a lack of data for this thesis, showed the importance of consistent monitoring and making data available. Firstly previous restoration attempts should be monitored to ensure they are still working as intended. River restoration schemes aim to help stabilise the river channel by adhering to the rivers natural equilibrium as much as possible. They must take into account the hydrology of the river and biotopes which form due to the hydrology, and this is becoming an increasingly common practice in urban rivers. Since the seminal studies of Angelier (1953), streams and their interstitial counterparts are not considered as distinct entities (Mermillond-Blondin *et al.*, 2000). "Attempts at rehabilitating the ecological condition of urban streams by 'restoration' projects have produced varied results, but a common finding is that projects do not often meet planned ecological goals" (Kondolf, 1998). River restoration and improvements in water quality have to be conducted on a catchment scale rather than as a series of individual projects which are unconnected. As a result restoration schemes are sometimes poorly implemented and monitored, and while huge clean-up operations are often hailed as successes, the extent of their success cannot be measured accurately due to lack of research.

6.2 The relevance of Waterways and Green Spaces in Urban Areas

Chiesura (2004) describes international efforts to preserve the environment "are mainly concerned with large, biodiverse, relatively untouched ecosystems or with individual animal or vegetal species, either endangered or threatened with extinction." It is true that most areas under protection are in order to preserve threatened or endangered species, however many sites under protection in England are not pristine ecosystems. In England there are currently 4100 Sites of Special Scientific Interest (SSSI's) which cover a total of 7% of the country's land area (Natural England, 2014). "Over half of these sites, by area, are internationally important for their wildlife. They are designated as Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Ramsar sites" (Natural England, 2014). In October 2014 a report conducted on behalf of Natural England was published on the overall condition of the SSSI's in England. The report stated 96.27% of sites were meeting PSA targets, 37.04% of sites were classed as favourable, 59.23 as unfavourable recovering, 2.08% as favourable no change, 1.62% as favourable declining and 0.03% as area destroyed/part destroyed (Figure 26). Unfavourable recovering is "often known simply as 'recovering': units/features are not yet fully conserved but all the necessary management mechanisms are in place (Natural England).

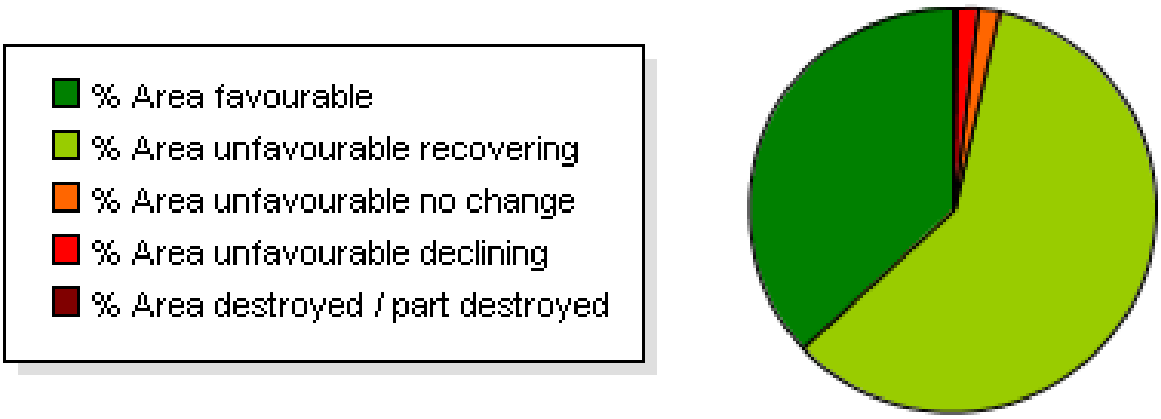


Figure 26: The percentage of Sites of Special Scientific Interest (SSSI's) in each category (Natural England, 2014)

Figure 26 shows almost two-thirds of the SSSI's in England are not currently being adequately conserved, although they are improving which counteracts Chiesura's (2004) argument that international efforts are only interested in preserving pristine ecosystems. The notion that only pristine ecosystems are currently being preserved is an outdated concept, particularly in the UK where significant funding is directed towards preserving SSSI's. Christie and Rayment (2012) concluded that maintaining SSSI's in England and Wales can be cost effective:

> "The public are willing to pay £956 m annually to secure the levels of services and benefits currently delivered by SSSI conservation activities, and a further £769 million to secure the benefits that would be delivered if SSSIs were all in favourable condition. These benefit estimates significantly exceed the annual £111 million costs of managing SSSIs, demonstrating that investing in biodiversity conservation can be cost effective."

Since the rise of railway networks and the later development of road transport, the economic value of inland waterways in the UK as freight carriers has steadily declined (Garrod & Willis, 1994). However the reduction of the reliance of canals as a means of transportation has been offset by their increasing popularity as a recreational resource. Canals and rivers add a greater amenity value for those residents living close to them (Garrod & Willis, 1994). Bourassa et al. (2003) concluded that attractive landscaping and buildings in a property's neighbourhood on average add 5% and 37% to value, respectively. Particularly attractive improvements in the immediate surroundings of a property added another 27% to value on average to those houses in their research area in Auckland, New Zealand. The perception of urban watercourses has altered over the past few decades and they are seen as desirable places to live near: people will pay premium prices to live alongside them (Garrod & Willis, 1994).

The presence of green spaces is also linked to improved health and increased standards of living: Takano, Nakamura and Watanabe (2002) found in their study of 3144 people, living in areas with walkable green spaces positively influenced the longevity of urban senior citizens regardless of their age, sex, marital status, baseline functional status and socioeconomic status. Taylor *et al.* (1998) also concluded that in their study, incidences of creative play of children were significantly lower in barren spaces than in relatively green spaces. Levels were approximately half as much as

those found in spaces with more trees and grass. Referring back to Wood *et al.* (1999), water quality and urban regeneration are closely connected. This makes small-scale biotope restoration projects essential in improving water quality to levels which can sustain macroinvertebrate and fish populations. The lack of biological data collected by the Environment Agency suggests macroinvertebrate and fish populations are not being monitored as thoroughly as they could. This is occurring at a time when other reports are stating that it is becoming increasingly important that we adequately monitor population changes to lessen the impact of climate change; The World Wildlife Fund published a report in 2014 stating that Earth has lost half of its wildlife in the past forty years (The Guardian, 2014). During rapid industrialisation and population increase, industrial cities such as Liverpool and Manchester developed at the cost of the River Mersey and its tributaries. The work conducted by the MBC and EA over the last thirty years has been primarily to reverse the environmental damage dealt as a consequence of industrialisation. The decimation of woodland and green spaces for the development of infrastructure has helped contribute to the loss of half of the earth's wildlife (The Guardian, 2014).

Shafik (1994) described the relationship between economic growth and environmental quality where two extremes are given: one is that greater economic activity leads to further environmental degradation, and the second is that environmental problems worth solving will be addressed automatically as a consequence of economic growth. Merseyside follows the first scenario; the development of Liverpool as a port led to further environmental degradation, the consequences of which were not acted on until Merseyside was in one of the worst economic crises since its industrialisation. It is only within the last thirty or forty years that areas such as Merseyside have started to utilise the benefits of integrating watercourses and green spaces into regeneration.

The redevelopment of urban green spaces such as Sefton and Princes Parks in Toxteth are important for a number of reasons; there are health, economic and social benefits. Cities which are rapidly expanding can learn from projects such as the MBC and the history of the development of other cities, for example Manchester and Birmingham, to incorporate the use of green space in urban development through urban planning and sustainable infrastructure. The words "eco" and "green" are being used increasingly frequently to describe development projects. Additional UK cities have and can continue to incorporate aspects of the MBC in their own work.

6.3 An Analysis of Toxteth

The relationships between household income, unemployment, deprivation levels, crime rates, child poverty GCSE grades and changes in population tend to correlate due to connections between economics. Inequalities between household incomes, and therefore disposable income, are the primary statistic in this data set which can be connected to most other variables.

6.3.1 Household Income and Unemployment

Household income can be affected by a multiple of variables such as pay inequality (Galbraith and Kum, 2005), low-skilled or poorly paid jobs and high unemployment. High unemployment is the primary influence of low household incomes in Toxteth: the area had an unemployment rate of 36% in 2011 (Liverpool Echo, 2011) and investment declined after the 1981 riots. The results show what is to be expected: the wards with the highest levels of income have the lower levels of unemployment and these results are almost directly proportional to one another. Princes Park's average household income was just £24,300 and its unemployment rate was 28%, around two and a half times that of the National Average. In comparison the National Average household income is £36,400 and the unemployment rate is just 11.2%.

All cities have areas which are deprived in relation to the areas around it, and one parallel which can be drawn between Liverpool and Toxteth is Manchester's Moss Side. Similarly to Toxteth, Moss Side also experienced rioting in the early 1980s and has struggled to remove its negative reputation. As a result of negative perceptions, deprived areas often enter a spiral of decline from which it is hard to escape. It can lead to a chicken-and-egg scenario; deprived areas which are seen as undesirable places to live and only attract people who cannot afford to live elsewhere. These residents are on poorly-paid jobs, unemployed or are reliant on welfare. This can stem from lack of education to find a better job, poor career aspirations, an inability to work due to disability or a single parent unable to afford childcare. There are a variety of other reasons as to why people live in deprived areas such as this, and the children growing up in these areas, especially those growing up in child poverty, are more likely to reside in these sorts of areas once they mature. It is a complex cycle to break.

6.3.2 Child Poverty

High rates of population change add increased pressure to resources such as hospitals and education. Both are variables which are used to calculate deprivation levels; poor access to health care due to increased population size can result in an increase in the percentage of deprivation. Webber and Butler (2007) highlighted the issue that people who can afford larger homes, 'Corporate Chieftains' as they are referred to in their research, are usually adults over the age of forty. They have worked their way through their chosen career paths and are usually at a later stage in their life; they are usually settled within the family home, have children and have a reliable, well-paid job. The nature of housing in Riverside and Princes Park is more suited to students, first-time buyers and people on low-pay or welfare. Housing typically found in a suburban area is typically suited to a more affluent, family orientated audience who are settled into an area and less likely to move.

Children are said to be in poverty if they live in a household with an income less than 60% of the National Average. The values of Child Poverty are subject to fluctuations more so than the other statistics, and relative child poverty is predicted to rise from its current value of 20% to 24% by 2020/21, the highest rate since 1999/2000 and considerably higher than the 10% target in the Child Poverty Act (Brewer, October 2011). Considering the initial target was 10% for the National Average Statistics, Princes Park ward is over five times higher than government targets, however even the National Average is double the government's target. Absolute poverty will rise considerably in the next few years as earnings growth is forecast to be weak but inflation high (Brewer, October 2011). Real median household income will remain below its 2009/10 level in 2015/16 (Brewer, October 2011). Princes Park's average household income is 66% of that of the National Average, resulting in over half of children living in the area falling into the category of being in child poverty. The impact of child poverty on the wellbeing and future prospects of a child has been studied extensively. One of the problems with child poverty is that children represent a country's future, an obvious reason for societal concern with a child's wellbeing (Bradbury *et al.*, 2001). Additionally children are unable to take responsibility for their circumstances and are dependent on others to raise them, and they themselves are not responsible for the conditions in which they were raised (Bradbury *et al.*, 2001).

6.3.3 GCSE Results and Education

Good educational facilities are important for children living in poverty as education is one of the only means of children improving their future job prospects, however high rates of population change can also factor into additional statistics such as poor GCSE grades. High population change rates increases the pressure on schools to increase class sizes to the extent that a child's education is compromised. Research conducted by Blatchford *et al.* (2003) of a study conducted in classrooms with children between 5 and 7 years of age found that that the smaller the class, the greater the teaching time for classes under 29 pupils (Figure 27). Even though in the UK there is a cap on class sizes above 30 in the early years, a recent Organisation for Economic Cooperation and Development (OECD) report has shown that class sizes and pupil teacher ratios in the UK are still amongst the highest in terms of international comparisons. There is also still a lot of variability in class sizes; many teachers would consider that 29 children in a class is still too many, despite Blatchford *et al.* (2003) stating that teaching time increased slightly when class sizes were of 29 pupils or more.. The research found the percentage of teaching times is in relation to the length of time allowed for the lesson. Larger class sizes mean more disruptions in lessons and this leads to reductions in actual teaching time.

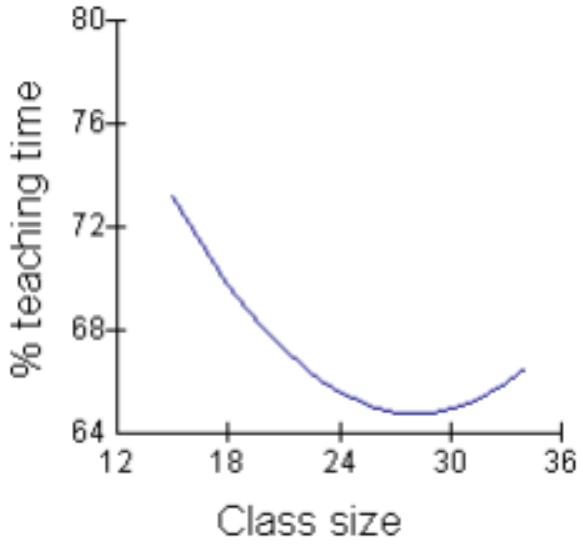


Figure 27: Relationship between teaching time and class size in a study of 5-7 year olds (Blatchford et al., 2003)

The percentage of children leaving school with 5 A* to C GCSE's is not as clear-cut as the previous results. Whilst the other statistics can be explained through low household incomes and high unemployment rates, poor GCSE results are also attributed to lack of investment in the education system. In addition high changes in populations over short periods of time result in underfunded schools having larger class sizes and poorer teacher to pupil ratios. This leads to reductions in teaching time and can lead to poorer GCSE results. Data from ten local secondary schools, the furthest of which is 1.2 miles from Toxteth's centre, should be available online; RM Education publishes data online which it gathers from the Department for Education and Ofstead, as well as the school's own descriptions of their facilities. However few schools make their data accessible; only four out of ten schools nearest to Toxteth publish their pupil data as well as Ofstead grades.

The Belvedere Academy has the highest percentage of students achieving grades A* to C (84%). 13% of students are eligible for free school meals and the school pupil numbers are currently under capacity (790 out of a possible 810). The ratio of pupils per teacher is 11.9.

Bellerive FCJ Catholic College is an all-girls academy for students aged 11 to 18. 64% of students leave with GCSE grades A* to C, including Maths and English. 30% of students are eligible for free school meals and pupil numbers are currently under capacity (875 out of a possible 908). The ratio of pupils per teacher is 14.3.

University Academy Liverpool is a mixed gender Academy with students aged 11 to 18. 33% of students achieved GCSE grades A* to C, 71% of students are eligible for free school meals and pupil numbers are currently well under capacity (635 of a possible 900).

Auckland College is a mixed gender, independent school teaching 3 to 18 year olds, with 17% of students achieving GCSE grades A* to C. The percentage of students entitled to free school meals in unavailable however the school is also under capacity (150 out of a possible 193).

Whilst there is insufficient data to produce any significant results or conclusions, additional literature backs up the idea that schools with higher percentages of children leaving with GCSE grades A* to C, including Maths and English, have a better pupils to teacher ratio. Blatchford *et al.,* (2003) emphasises that classes which are too large lead to reduced overall teaching times. This is partially due to more disruptions, but is also primarily due to a lack of time teachers are able to spend with individual pupils.

6.3.4 The Link Between GCSE Grades and Child Upbringing

Poor GCSE rates are highest in Princes Park, an area which so far has consistently proved the worst in each category as seen in figure 20. Poor GCSE levels can be attributed to cuts in education or parents spending less money on their child's education, but it may also related to the way parents bring up their children. Older parents with more money, similar to those labelled as 'Corporate Chieftains' by Webber and Butler (2007), can push their children into furthering their education due to the history of their own successes. There are several schools around the Toxteth area; The Belvedere Academy is a private all-girls school with 84% of students achieving 5 A*-C's at GCSE level, however fewer than one in five students leave Auckland College with the basic GCSE results, including Maths, English and Science, to get themselves better paid and qualified jobs. Households which can afford to send their children to better schools in or around Toxteth drastically increase their prospects of their children being able to find employment or go to university once they leave sixth form or college.

There are a series of benefits which parents of children being brought up in poorer households are entitled to which are designed to ensure that all children have a similar school experience regardless of their household income. In England all children in reception and years 1 and 2 at state schools automatically qualify for free school meals, and older students can qualify for free school meals if their parents claim income support, income-based Jobseekers Allowance or income-related Employment and Support Allowance. Children may also be entitled to free school meals if their parents are on income support sustained under Part VI of the Immigration and Asylum Act 1999, the guaranteed element of State Pension Credit, Child Tax Credit (provided they are not also entitled to Working Tax Credit and have an annual gross income of no more than £16,190), Working Tax Credit run-on - paid for 4 weeks after they stop qualifying for Working Tax Credit, and Universal Credit (gov.uk, 2014).

Although there are only three schools around Toxteth which have published their grades and percentage of students claiming free lunches, the school with the poorest GCSE results also has the highest percentage of students claiming free school meals.

Webber and Butler's 2007 paper reinstated the idea that children from poorer backgrounds usually achieve lower grades in their GCSEs than children from

wealthier families. They found that "Of the 61 Mosaic neighbourhood types, the one whose pupils achieve the most favourable GCSE results are labelled A03, 'Corporate Chieftains', with an average of 56.29 points. By contrast the one whose pupils perform least well are labelled F40, 'Families on Benefit', with an average of 24.15 points." The Corporate Chieftains category consists of very wealthy people, many of whom are senior business managers living in large detached houses in outer metropolitan suburbs. Webber and Butler (2007) found that the people living in these larger homes were typically over 40 years of age, and had enough disposable income to spend more on their children's education.

Webber and Butler (2007) defined 'Low Horizons' as areas contains large numbers of people in large provincial cities, who are on low incomes and are particularly dependent on city councils for housing and for transport: "Though not necessarily areas of acute social deprivation and still having the benefit of active family and community support networks, these are nevertheless communities where horizons are low and where few people have been converted to the culture of optimistic self-reliance that has characterised lower occupational groups living in small towns and southern regions of the country."

The contrast between GCSE grades in poor and wealthier families is further highlighted by Machin and McNally's (2006) literature review on education and child poverty. They summarised their findings by stating "there is good evidence that education has a strong influence on the probability of employment and higher wages (although this is conditional on the type of education undertaken)." They also stated that "it is more realistic to see measures to increase educational attainment as part of a longer-term strategy to reduce child poverty, alongside other social policies that have a more immediate effect on household income."

The issue of child poverty needs a long-term solution, especially in places such as Toxteth where low household income and high unemployment have dominated the area for the last thirty to forty years. Only once these issues are addressed under a long-term plan will educational attainment be in line with the National Average statistics. Children are not responsible for their early upbringing, and it is important to bridge the gap between rich and poor students to ensure a good education is available to all children regardless of money.

6.3.5 Crime rates in Toxteth and Merseyside

Referring back to figure 22, crime rate statistics initially appear to be an anomaly as Princes Park is not the ward with the highest levels of crime. Riverside's crime rate is two and half times that of Princes Park and almost four times higher than the National Average. Household income, unemployment and child poverty statistics label Princes Park as the poorest ward, and it would be reasonable to predict that it would also have the highest levels of crime.

The UK Crime Stats website publishes crime statistics which are published online every month. These statistics are not produced by Ward, but on a larger area which also extends to North Liverpool. The UK Crime Stats labels this area as Riverside, but it covers an area several times greater than the Riverside Ward, and the two are not to be confused with one another. In this area violent crimes consistently contribute well over one tenth of all recorded crime. In October 2014, 286 counts of violent crime were recorded out of a total of 2063 recorded crimes. Figure 28 breaks down the statistics for all reported crime into individual categories, and the data was gathered from November 2013 to October 2014. Anti-social behaviour accounts for almost a third of all crime reported in the 'Riverside' area. Whilst it is not possible to produce a graph of crime breakdown for individual wards, the data gathered by the UK Crime Stats website goes some way to explaining why crime rates in the Riverside ward may be so high compared to the National Average and Liverpool average statistics.

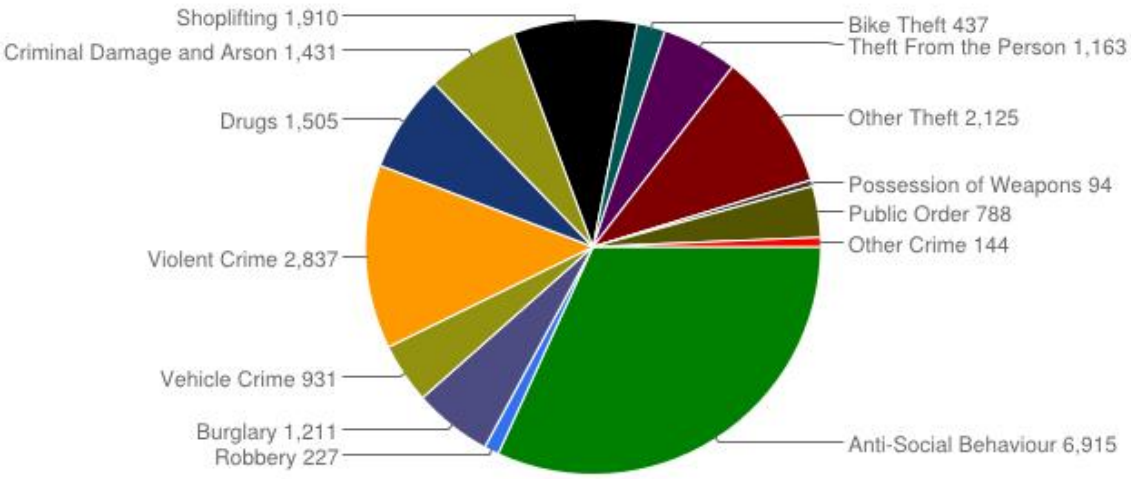


Figure 28: Crime Breakdown from November 2013 to October 2014 (UkCrimeStats.com)

Kawachi *et al.* (1999) argued that "two sets of societal characteristics influence the level of crime: the degree of relative deprivation in society (for instance, measured by the extent of income inequality), and the degree of cohesiveness in social relations among citizens (measured, for instance, by indicators of `social capital' and `collective efficacy')." The area in and around Toxteth is deprived not just in comparison to other areas of Merseyside, but is in the most 1% deprived areas nationally. The degree of relative deprivation in accordance to Kawachi *et al.* (1999)'s paper explains why areas of Merseyside experience high crime rates, primarily anti-social behaviour related.

6.3.6 The Significance of Deprivation in Toxteth

'Deprivation' defines a standard of living or a quality of life which is below that of a particular society to the extent that it involves hardship, inadequate access to resources and underprivilege (Herbert, 1985). It is the most difficult statistic to analyse not just because it is a combination of all the data collected by Liverpool City Council, but because 'deprivation' is relative. "The Indices of Deprivation 2010 is based on the concept that deprivation consists of more than just poverty. Poverty is not having enough money to get by on, whereas deprivation refers to a general lack of resources and opportunities" (Herbert, 1985). The statistics for deprivation are generated based on ten indices and a total of thirty eight separate indicators grouped into seven domains: income, employment, health, education, crime, access to services and living environment. Each of these domains has their own scores and ranks. To calculate deprivation levels across the UK, all data needs to be compared to a national average.

As deprivation statistics are comprised of a series of data sets, low household income, high unemployment rates, high child poverty percentages, high crime rates and poor GCSE grades all contribute to Riverside and Princes Park Wards being in the 1% most deprived nationally. As a result Toxteth's deprivation is a result of failings in many categories which cannot be solved by regeneration alone. The Mersey Basin Campaign has not been successful in improving inner city areas such as Toxteth because the issues that needed to be dealt with were far beyond the capacity of the MBC. Education, unemployment and housing issues need to be addressed in order for Toxteth to capitalise on the successful regeneration of Liverpool City Centre and other successes of the MBC.

6.4 Housing in Toxteth

Referring back to figure 23, Princes Park has the highest level of small, low quality housing: 88.7% of all housing is categorised in council tax band A, which is defined as a household being valued at under £40,000 in 1991. In comparison figure 24 shows Riverside has 55.8% of housing in council tax band A, 13.1% in band B and 30.9% in band C or higher. Comparing this to the Liverpool Average, 60.5% are in council tax band A, 17.1% in band B and 22.2% in band C or higher. The lack of larger houses in Princes Park reflects the low average income; most people in this area cannot afford bigger homes on restricted incomes. Toxteths's housing situation is very complex; the housing statistics appear as they are due to the nature of housing around both Sefton and Princes Parks. Further research of the site revealed many of the large Victorian houses had been converted into four or six flats per house, making the council tax band statistics appear as if Toxteth has high levels of small, low cost housing.

Toxteth's abundance of cheap housing has proven beneficial in establishing the area as a popular student location: Liverpool John Moores University is one of the closest universities to Toxteth and has approximately 25,000 students and 2500 members of staff (Liverpool John Moores University, 2015). The University of Liverpool, also located relatively near Toxteth, has approximately 23,000 students and 5600 members of staff. Both universities have a combined student population of nearly 50,000 students, many of which will be living in Liverpool. The University of Liverpool also states that 6 out of 10 of graduates remain in Liverpool (University of Liverpool, 2015).

The council tax statistics supplied by Liverpool City Council do not accurately reflect Toxteth's housing situation; It is its abundance of small, low cost housing that has enabled the area to develop as a popular student residential area, and students are an invaluable economic source. Their student loans are spent primarily on accommodation; however additional money is spent in the local community. Additionally the universities ensure a supply of workers who are degree educated, even if the local community has poorer average GCSE qualifications and household incomes.

Despite the volume of affordable housing available to students, Toxteth still has a housing crisis. Dozens of empty homes were due for demolition (figure 29), but after

Figure 29: Some of the homes in Toxteth which were due for demolition, but have been saved after a local campaign

fierce opposition the homes are to remain intact. One of the homes due for demolition was the birthplace of one of the Beatles, Ringo Starr, a fact that was used in defence of keeping the housing. Rows of housing have remained derelict since the decision to preserve them has been overturned. The community has been brought together over plans to save some of Liverpool's most historic monuments and has resulted in wider community engagement (Anelay, 2014).Whilst many of the houses currently remain derelict, a Liverpool Council scheme in which people could buy a home for £1 on the condition that they renovate it was implemented in 2013, starting with the sale of 20 homes. Some of the houses in this scheme had been left derelict for twenty years and in late 2014 the first applicant moved in having redeveloped the £1 home at a cost of £30,000 (Liverpool Echo, 2015). In total, nearly 200 derelict properties in the Granby, Picton and Arnside Road areas of Liverpool are being brought back into use under a huge regeneration scheme (The Guardian, 2014). Whist a housing developer has been involved in the scheme as a profit-making venture; the £1 homes scheme enables local residents to purchase houses in their local area when they may have been priced out under different circumstances.

Whilst housing developments are often seen as a solution to the current housing crisis and as a method of regeneration, there is little point in building large, expensive housing if few local people can afford to relocate there. This often results in a cycle: if an area is seen as deprived, affluent residents often relocate elsewhere. Residents who accumulate enough wealth to afford better housing have a greater choice in other areas of Merseyside with lower crime rates, better schools and stable population change rates.

6.5 Liverpool's European Capital of Culture: The Effect on Toxteth

Liverpool's European Capital of Culture award was not only comprised of recent projects: Liverpool has always had a strong cultural background, particularly due to the performing arts and music industry in addition to its historic docks. Local artists have had so many Number One hits that in 2001 the Guinness Book of Records named Liverpool the world 'City of Pop'.

An "Impacts 08" report conducted by Liverpool John Moores University and the University of Liverpool examines the impact that Liverpool's European Capital of Culture award had on Liverpool. However the report only appears to focus on the very heart of the city centre of Liverpool, and does not take into account the suburban areas. Therefore it fails to integrate the statistics of the most deprived areas in the outskirts of Liverpool, therefore making it more difficult to assess the economic and social impacts that Liverpool's European Capital of Culture Award may have had on areas such as Toxteth. The legacy left by the Mersey Basin Campaign and other partners has been a successful one in Liverpool City Centre, but the Campaign has not had the same impact in inner city areas such as Toxteth. However as the Impacts 08 report suggested, social perceptions of Liverpool have been greatly increased as a result. Positive stories increased by 71% between 2007 and 2008, overall positive impressions of Liverpool increased from 53% to 60% and 77% of visitors felt the city was 'safer than they expected' (Impacts 08 Report; Garcia *et al.,* 2010). The Impacts 08 report) stated that:

> "It was "geographically and socio-economically inclusive: in 2008, one third of the audience was local, one sixth from beyond the region, and nearly 5%

> international. In 2008 there were an estimated 27.7 million visits to Liverpool, a 34% rise on the previous year; and 75.1 million visits to Merseyside, a 19% rise on 2007. Merseyside saw a 20% rise in day visits between 2007 and 2008." In comparison other areas of the North West only saw increases between 1 and 4%. Greater Manchester experienced a 7% drop in this time frame."

In 2009 after Liverpool's year as the European Capital of Culture (ECoC) ended, the Impact 08 report stated:

> "Events delivered under the Liverpool ECoC brand received over 90% positive or neutral coverage throughout this period. Positive stories on Liverpool as a city grew by 71% in the national press between 2007 and 2008. Local papers have increased positive city coverage since 2003 (from 39% to 56%).From 2005 to 2008 overall positive impressions of Liverpool increased amongst the UK population (from 53% to 60%) while negative views dropped from 20% to 14%.By the end of 2008, 77% of visitors felt the city was safer than they expected" (Impacts 08 Report, Garcia *et al.*, 2010).

The ECoC award effectively improved people's perceptions of Liverpool as a city; however these perceptions are not equally distributed throughout the Merseyside area. However if the publicity surrounding Liverpool's ECoC award led to increased student numbers at either the University of Liverpool or Liverpool John Moores University, it is likely that Toxteth will have seen an increase in its student population. This leads to increased spending by the student population as well as an influx of graduates into Liverpool, some of whom are likely to live in Toxteth due the nature of its cheap affordable housing. Considering the success of Liverpool's European Capital of Culture Award in 2008 and the Mersey Basin Campaign's 25 year lifespan, Liverpool still has unemployment rates far higher than the national average statistics, as well as higher crime and child poverty rates. Its average income is also over £6000 lower than that national average. The combination of the MBC and the European Capital of Culture Bid aimed to improve regeneration but neither claimed to improve education facilities, low household income or high crime rates; the underlying issues of Toxteth's deprivation have not been addressed

6.6 The Mersey Basin Campaign and Sustainable Regeneration

Lombardi *et al.* (2011) stated "Urban regeneration has a substantial impact on all three dimensions, sometimes known as pillars, of sustainability: society, economics and environment; it is therefore an activity of considerable importance to achieving a more sustainable society." Rousseau (2009) argued that in his research that "governments in France and the UK came to the view that middle-class reinvestment in city centres offers a solution to urban decline, and have therefore encouraged the middle class to move by implementing 'symbolic policies'". The paper mentions that "their objective is to transform the image of a post-industrial city through cultural and urban planning policy in order to adapt it to the supposed taste of potential gentrifiers."

The Mersey Basin Campaign aimed to stimulate the development of attractive waterside environments for businesses, housing, tourism, heritage, recreation and wildlife through investment in regeneration. However regeneration is a vague term. The concept of regeneration is not simple; it can be approached from many angles and the regeneration of Liverpool City Centre from a cultural perspective was an appropriate method to use. Liverpool's industrial and multicultural history combined with its focus on musical connections meant that subsequent regeneration could be built on aspects which had previously made Liverpool one of the first industrial cities globally. The development of Liverpool One was a means of updating Liverpool to a 21st century city; Urban regeneration programmes in the UK over the past 20 years have increasingly focused on attracting investors, middle-class shoppers and visitors by transforming places and creating new consumption spaces (Raco, 2003).

The regeneration of Liverpool City Centre, Manchester City Centre, Salford Quays and the development of Media City represent the successes in which some aspect of the Mersey Basin Campaign has been at least partially involved. However these regeneration schemes have not successfully improved some of the inner city areas which were, and still are, some of the most deprived areas of the UK. Toxteth still has not reaped the full benefits of Liverpool City Centre's regeneration, although recent housing plans and developments may contribute to the future of Toxteth over the next decade. The regeneration of Salford Quays has also failed to impact some of the local Salford residents as many of the people employed at Media City relocated for their job and few local people were employed under the project.

Urban regeneration is becoming an increasingly common practice, primarily in the developed world which is feeling the impact of deindustrialisation more than countries such as China which are still very much in their industrial era. As a result, in the UK "The economic crisis of the 1970s and relocations of industry linked to accelerating globalization affected them intensely and lie at the root of the social problems encountered by their population" (Rousseau (2009). Both Rousseau (2009) and Raco (2003) mentioned that regeneration is targeted at the middle class, however many of the local residents living in inner city areas such as Toxteth and Salford are more working class than middle class; the statistics for Toxteth in this research demonstrate that this is the case. Boyko *et al*. (2011) reinforces this by saying "The need for affordable housing increases, as attention is focussed on more niche markets (e.g., luxury flats for couples with no children) at the expense of equality. Access to public green space also will suffer, as such land uses may be converted for development purposes, or may become private or semi-private spaces."

There is an argument that this method of regeneration is unsustainable as it does not solve the problems of inner city decline; it creates additional problems elsewhere. By neglecting areas such as Toxteth which are occupied primarily by people who are regarded as working class, it reinforces a social stigma which is further emphasised by the regeneration of areas such as Liverpool City Centre which cater for a middle-class audience. Toxteth still has not completely removed its reputation gained by the 1981 Toxteth riots and it is seen as a 'trouble spot' as a result, however some of the most vulnerable members of society fall victim as a result, and this becomes a greater issue when children are affected as a consequence of this.

Liverpool City Council has been successful in many of its regeneration projects, but it needs to bridge some of the gaps of housing and job inequality as well as class prejudice. Many cities have social problems which ought to be addressed by some of the regeneration efforts undertaken in city centres, however social and community issues do not appear to be one of the top priorities for either Councils or local Government. Sustainable regeneration needs to take into account greater issues in society rather than focusing solely on the economic and environmental aspects. The MBC incorporated environmental improvements, but not societal.

7. Conclusion

Industrialisation resulted in most rivers within the UK being polluted (Hassan, 1985), and Jones (2000) stated that the Mersey was once one of the most polluted rivers. The aim of the Mersey Basin Campaign was to address the problem of water quality and associated dereliction on a river catchment (Bannister et al., 2005). This research has comprehensively investigated whether the Mersey Basin Campaign has fulfilled its initial aims.

7.1 Summary of Aims and Objectives

Referring back to the aims of the Mersey Basin campaign, the project intended:

> To improve river quality to at least fair standard by the year 2010 so that all rivers and streams are clean enough to support fish;
>
> To stimulate the development of attractive waterside environments for businesses, housing, tourism, heritage, recreation and wildlife.

The aim of this research was to evaluate how successfully the MBC has improved water quality across the Mersey catchment and whether it has met its own aim. Therefore the two primary questions which have been addressed in this thesis were:

> What was the state of water quality across the watercourses in the Mersey Catchment at the end of the Mersey Basin Campaign, and how has it improved over the final ten years of the Campaign?
> To what extent has the Mersey Basin Campaign been successful in improving Toxteth, one of the most deprived areas of Liverpool?

Whilst overall water quality has improved within the Mersey Catchment, the MBC did not fulfil its aims of increasing all watercourses to a fair standard by 2010. The average results for the thirty field sites demonstrate this. The results show that improvements have been made in all four categories which relate to water quality; chemistry, biology, nitrates and phosphates content, however this has not significantly improved to “fair” or “good” standard across all field sites.

This research also identified some of the categories which the Mersey Basin Campaign and Environment Agency was not controlling adequately enough to improve water quality in the Mersey catchment at a better rate; nitrate pollution in the Mersey Catchment was not controlled as effectively as possible for the MBC to have improved water quality to a sufficient standard. Biological data was not being conducted as thoroughly as necessary, and the data which was actually collected proved the MBC was failing to meet its water quality targets in several criteria.

The lack of water quality monitoring, combined with the lack of data available on both biotope and water quality improvement projects within the Mersey Catchment, reveals that the Mersey Basin Campaign's aim to improve all watercourses within the Mersey Catchment was unrealistic. The Environment Agency is only a single government department which cannot cope with adequately monitoring field sites within the River Mersey. Additionally five million people live within the Mersey catchment: it is very unrealistic to presume that all water quality can be significantly improved when there are great volumes of effluent disposal across such a large urbanised catchment Bell & Gray (2002) picked up on the complexities the Environment Agency faces and highlighted the issue that sometimes too much is expected of a single organisation.

Secondly, the MBC has failed to improve some of the worst affected inner city areas such as Toxteth, primarily due to the problems in this area being more problematic for regeneration alone to solve. Although the Heritage Lottery Fund has invested millions in improving two of Toxteth's parks, regenerating local parks and watercourses has not had a great impact on the overall regeneration of Toxteth. The council statistics paint a bleak picture for Toxteth with its high unemployment and deprivation, low household income and GCSE pass rates; academic literature combined with additional research findings also concluded that the area around Toxteth as well as other areas of Liverpool are still some of the most deprived regions in the UK. The Mersey Basin Campaign's main focuses were improving water quality and encouraging regeneration; however the focus appeared to be on improving water quality more than encouraging redevelopment. It has been established that improving water quality and regeneration do not have to be intimately connected in order for the project to be a success, but very poor water quality is detrimental in reducing people's perceptions of an area and Wood *et al.* (1999) were correct to a certain extent.

The statistics for Toxteth also suggest that the problems are extremely complex, and are not liable to change through regeneration alone. There is a clear connection between child poverty, crime rates, GCSE grades and household income, and urban decline is a vicious cycle under these conditions. Education and lowering unemployment are the two areas to focus on most in improving Toxteth; the problems of derelict housing in Toxteth are already being addressed and Liverpool's reputation has improved significantly over the last fifteen years.

7.2 Limitations

There were multiple problems encountered during the data collection. Firstly the data collected by the Environment Agency was collected on a yearly basis until 2009, however there are many incomplete data sets which selecting a series of field sites very difficult. Whilst selecting field sites using the 2009 data set, around half of the potential field sites selected had biological data missing or no available data, resulting in the number of field sites being used in this thesis reduced from fifty to thirty. Additionally the Environment Agency (2014) states that they sample around 7000 river and canal sites 12 times a year, and test water chemistry, biology and nutrient levels, however samples for biology are collected every 3 years. This explains why the biology statistics are missing from a lot of the field sites monitored in 2009.

There were also issues with the grading system used by the Environment Agency and the Mersey Basin Campaign, as well as academic publications. The MBC aimed to achieve a "fair" standard of water quality across the Mersey catchment; however the grading system used by the Environment Agency did not factor in a "fair" category. The grading system used by the Environment Agency until 2009 for Chemistry and biology varied from grades A to F (very good to bad), and Nitrates and phosphates vary on a scale from 1 to 6 (very low levels to very high levels).

In addition from the lack of complete data sets collected by the Environment Agency, the lack of water quality data from 1985 to 2000 meant that a proper comparison between water quality at the start and end of the Mersey Basin Campaign was impossible. Only academic literature and media reports suggested how polluted the River Mersey was and does not back up its claims with useable data.

7.3 What the future holds for Toxteth

The council's statistics appear to represent Toxteth as a deprived area with high unemployment, poor quality housing and poor standards of education. However future plans for Toxteth to regenerate the area as an extension of Liverpool's city centre are providing a hopeful future for the area. This technique has already been utilised successfully at Salford Quays, and can hopefully be replicated within Toxteth. Cultural regeneration is not a form of redevelopment which can be utilised in any town or city: it is usually used in a city which has a rich cultural history which can be built upon; Toxteth is very lucky in that respect. Cultural regeneration is not the best concept which could be used to revive a failing market town, nor would it be likely to be successful in a modern village. Cultural regeneration is one of only a series of techniques which need to be used in conjunction with investment in education and job creation to have a lasting impact in Toxteth.

Toxteth has also guaranteed itself a future as a popular student's residential area due to its cheap housing and abundance of small flats. Whilst the initial council's housing statistics suggest that the volume of poor quality, small housing is a negative attribute, Toxteth would not have thrived as a student community without it. The influx of students means that many students are likely to stay in the area once they graduate, providing a steady inflow of highly qualified young professionals.

The Toxteth riots were detrimental in damaging to reputation of Toxteth. Many people who have never visited the area still regard it as 'rough' due to its dubious history in the media, and Toxteth has struggled to remove these connotations. Whilst Toxteth has struggled to regenerate itself effectively during the Mersey Basin Campaign's 25 year lifespan, further regeneration attempts may be more successful since Liverpool has successfully regenerated its city centre as a cultural hotspot. It's European Capital of Culture Award in 2008 along with the development of its huge shopping centre have provided Liverpool with enough publicity to become one of the North Wests most popular tourist destinations. With continued development and a high student population, this should draw in investment from firms and businesses looking to relocate their offices.

There are a number of organisations which are currently carrying out further work across the North West of England to try and improve water quality and regeneration,

one of which is The Atlantic Gateway project. This organisation still aims to promote sustainable urban growth across Liverpool and Manchester and aims that by 2030 they will have established a potential job creation of 250,000 around 140,000 of these jobs will be associated with Atlantic Gateway priority projects involving £14 billion of new investment (AtlanticGateway.co.uk, 2012). City-regions are widely recognised as key to economic and social revitalisation and the Atlantic Gateway project has been undertaken by Peel Holdings, the primary company involved in the redevelopment of Salford Quays. It is not possible to say how this will affect Toxteth until further developments have been undertaken, however a sustainable urban growth scheme across Liverpool and Manchester should encourage growth in Toxteth.

8. References

Alvaro, N.V., Wallenstein, F.F.M.M., Neto, A.I., Nogueira, E.M., Ferreira, J., Santos, C.I., Amaral, A.F. (2008). The use of digital photography for the definition of coastal biotopes in Azores. *Hydrobiologia*, 596, 143–152.

Amin, A. (2002). Ethnicity and the Multicultural City: Living with Diversity. Report for the Department of Transport, Local Government and the Regions and the ESRC Cities Initiative.

Anelay, C. (2014). Project reflections: The Florence Institute, Toxteth, Liverpool. *Journal of Building Survey, Appraisal & Valuation*, 3(2), 139-151.

APEM. (2007). Manchester Ship Canal; Strategic Review of Fish Populations. Ref: 410039.

Atlantic Gateway. (2012). Retrieved 19th of January, 2015 from *http://www.atlanticgateway.co.uk/*

Bannister, N., Mant, J., Janes, M. (2005). A Review of Catchment Scale River Restoration Projects in the UK: Compiled by the River Restoration Centre, Report December 2005.

BBC. (2004). Retrieved 10th of May 2015 from http://news.bbc.co.uk/1/hi/england/merseyside/3644164.stm.

BBC. (August 2011). Retrieved 15th of March 2015 from http://www.bbc.co.uk/news/uk-14710478

Bitelli, G., Gatta, G., Girelli, V.A., Vittuari, L., Zanutta, A. (2011). Integrated Methodologies for the 3D Survey and the Structural Monitoring of Industrial Archaeology: The Case of the Casalecchio di Reno Sluice, Italy. Hindawi Publishing Corporation *International Journal of Geophysics*, Volume 2011, Article ID 874347, 8 pages, doi:10.1155/2011/874347.

Blatchford, P., Bassett, P., Goldstein, H., Martin, C. (2003). Are class size differences related to pupils' educational progress and classroom processes? Findings

from the Institute of Education Class Size Study of children aged 5-7 Years. Institute of Education, University of London, March 2003.

Borja, A. (2006). The European water framework directive: A challenge for nearshore, coastal and continental shelf research. *Continental Shelf Research*, 25(14), 1768–1783.

Bourassa, S.C., Hoesli, M.E., Sun, J. (2003). What's in a view?

Boyko, C.T., Gaterell, M.R., Barber, A.R.G., Brown, J., Bryson, J.R., Butler, D., Caputo, S., Caserio, M., Coles, R., Cooper, R., Davies, G., Farmani, R., Hale, J., Hales, C., Hewitt, N., Hunt, D.V.L., Jankovic, L., Jefferson, I., Leach, J.M., Lombardi, D.R., MacKenzie, A. R., Memone, F.A., Pugh, T.A.M., Sadler, J.P., Weingaertner, C., Whyatt, D., Rogers, C.D.F. (2011). Benchmarking sustainability in cities: The role of indicators and future scenarios. *Global Environmental Change*, doi:10.1016/j.gloenvcha.2011.10.004.

Brewer, M. October 2011. Child and working-age poverty from 2010 to 2020.

Bridges, L. (1981). Keeping the lid on: British urban social policy, 1975-81. *Race & Class*, 23(2-3), 171-185.

Broody, M. (1955). The Social Adjustment of Chinese Immigrants in Liverpool. *The Sociological Review*, 3(1), 65-75.

Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*, 68(1), 129–138.

Christie, M., Rayment, M. (2012). An economic assessment of the ecosystem service benefits derived from the SSSI biodiversity conservation policy in England and Wales. *Ecosystem Services* 1.1, 70-84.

Cooper, P. (1985). Competing Explanations of the Merseyside Riots of 1981. *British Journal of Criminology*, 25(1), p60.

Craig, P.J., Morton, S.F. (1976). Mercury in Mersey estuary sediments and the analytical procedure for total mercury. *Letters to Nature*, 261, 125-126.

Daramola-Martin, A. (2009). Liverpool One and the transformation of a city: Place branding, marketing and the catalytic effects of regeneration and culture on repositioning Liverpool. *Place Branding and Public Diplomacy* 5, p301-311

Department for Environment, Food and Rural Affairs. (March 2010). The Development of the Water Industry in England and Wales.

Department of Education. (2014). Retrieved 15th of March 2015 from http://home.rm.com/SchoolFinder/ShowSchools.aspx?l=Toxteth,Liverpool&t=sec

Dicken, P. (2003). Global Shift: Reshaping the Global Economic Map in the 21st Century. P1.

Entwistle, N., Milan, D., Heritage, G. (2010). Biotope mapping using combined LiDAR and acoustic Doppler profiler survey

Eyler, J.M. (2001). The changing assessments of John Snow's and William Farr's cholera studies. *Sozial- und Präventivmedizin*, 46(4), 225-232.

Farrer W., Brownbill, J. 1907. Townships: Toxteth Park. A History of the County of Lancaster, 3, p40-45.

Fieldhouse, K. (1984). International Garden Festival 1984. *Landscape Design*, 148, 12-75.

Friberg, N., Kronvang, B., Hansen, H.O., Svendsen, L.M. (1998). Long-term, habitat-specific response of a macroinvertebrate community to river restoration. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 8, 87–99.

Frost, D. (1996). Racism and social segregation: Settlement patterns of West African seamen in Liverpool since the nineteenth century. *Journal of Ethnic and Migration Studies*, 22(1), 85-95.

Galbraith, J.K., Kum, H. (2005). Estimating the Inequality of Houehold Incomes: A statistical approach to the creation of a dense and consistent global data set. *Review of Income and Wealth*, 51(1), 115-143.

Garcia, B., Melville, R., & Cox, T. (2010). Creating an impact: Liverpool's experience as European capital of culture. Impacts 08.

Garrod, G., Willis, K. (1994). An economic estimate of the effect of a waterside location on property values. *Environmental and Resource Economics*, 4(2), 209-217.

Gregory, C., Brierley, G., Le Heron, R. (2011). Governance Spaces for Sustainable River Management. Geography Compass, 5(4), 182–199.

Gov.uk. November 2014. Retrieved 28th of March 2015 from https://www.gov.uk/apply-free-school-meals

The Guardian. (2008). Liverpool culture venues welcome 15m visitors in 2008. Retrieved 19th of January, 2015, from http://www.theguardian.com/culture/2008/dec/11/liverpool-capital-culture

The Guardian. (2011). Toxteth revisited, 30 years after the riots. Retrieved 19th of January, 2015, from *http://www.theguardian.com/uk/2011/jul/03/toxteth-liverpool-riot-30-years*

The Guardian. (2012). MP demands inquiry after BBC hires just 24 local people at Salford HQ. Retrieved 19th of January, 2015, from *http://www.theguardian.com/media/2012/jan/18/mp-inquiry-bbc-salford*

The Guardian. (2014). Earth has lost half of its wildlife in the past 40 years, says WWF. Retrieved 15th March 2015 from http://www.theguardian.com/environment/ 2014/sep/29/earth-lost-50-wildlife-in-40-years-ww

The Guardian. (2014b). The Liverpool locals who took control of their long-neglected streets. Retrieved 21st of May 2015 from http://www.theguardian.com/artanddesign/2014/nov/27/liverpool-locals-took-control-long-neglected-streets

Hassan, J.A. (1985). The Growth and Impact of the British Water Industry in the Nineteenth Century. *The Economic History Review*, 38(4), 531-547.

Herbert, D.T. (1985). Urban Deprivation: definition, Measurement and Spatial Qualities. *The Geographical Journal*, 141(3), 362-372.

Heritage Lottery Fund. 2015. Retrieved 10th of May 2015 from http://www.hlf.org.uk/.

Jones, P.D. (2000). The Mersey Estuary – Back from the dead? Solving a 150 year old problem. *Water and Environment Journal*, *14*(2), 124-130.

Jones, P.D. (2006). Water quality and fisheries in the Mersey Estuary, England: A historical perspective. *Marine Pollution Bulletin*, 53(1-4), 144-154.

Jones, P., Wilks-Heeg, S. (2004). Capitalising Culture: Liverpool 2008. *Local Economy*, 19(4), 341-360.

Jordan, A. (1993). Integrated pollution control and the evolving style and structure of environmental regulation in the UK. *Environmental Politics*, 2(3), 405-427.

Kallis, G., Butler, D. (2001). The EU Water Framework Directive: measures and implications. *Water Policy*, 3(2), 125-142.

Kasahara, T., Hill, A.R. (2008). Modelling the effects of lowland stream restoration projects on stream–subsurface water exchange. *Ecological Engineering*, 32(4), 310–319.

Kawachi, I., Kennedy, B.P., Wilkinson, R,G. (1999). Crime: social disorganization and relative deprivation. Social Science & Medicine, 48(6), 719-731.

Keeble, D. (1978). Industrial Decline in the Inner City and Conurbation. *Transactions of the Institute of British Geographers*, 3(1), 101-114.

Klein, L. 1962. Causes and Effects: River Pollution, Volume 2. P13.

Kondolf, G. M. (1998). Lessons learned from river restoration projects in California. *Aquatic Conservation*, 8, 39–52.

Lampard, E. E. (1973). The urbanizing world. *The Victorian city: images and realities*, 3-58.

Landres, P.B., Verner, J., Thomas, J.W. 1988. Ecological Uses of Vertebrate Indicator Species: A Critique. *Conservation Biology*, 2(4), 316-328.

Langston, W.J. (1986). Metals in Sediments and benthic Organisms in the Mersey Estuary. *Estuarine, Coastal and Shelf Science*, 23(2), 239-261.

Liverpool City Council. (2013). Data retrieved from http://liverpool.gov.uk/council/key-statistics-and-data/ward-profiles/ward-map/.

Liverpool Echo. (2006). Retrieved 10th May from http://libcom.org/news/article.php/toxteth-report-promises-240606.

Liverpool Echo. (2011). Toxteth's toxic legacy: Liverpool is still feeling the impact of the Toxteth riots. Retrieved 19th of January 2015 from

http://www.independent.co.uk/life- style/history/toxteths-toxic-legacy-liverpool-is-still-feeling-the-impact-of-the-toxteth-riots-2305044.html

Liverpool Echo. (2015). Granby 4 Streets housing project appeals for help with building materials. Retrieved 21st of May 2015 from http://www.liverpoolecho.co.uk/news/granby-4-streets-housing-project-8942786

Liverpool-ONE. (2015). Data retrieved 10th May 2015 from http://www.liverpool-one.com/media.aspx

Lombardi, D. R., Porter, L., Barber, A., Rogers, C. D. (2011). Conceptualising sustainability in UK urban regeneration: a discursive formation. *Urban Studies*, *48*(2), 273-296.

Machin, S., McNally, S. (2006). *Education and child poverty*. York: Joseph Rowntree Foundation.(http://www.jrf.org.uk/publications/education-andchildpoverty literature-review).

Mason, C.F., Macdonald, S.M. (2009). Otters: Ecology and Conservation, p135.

Mc Callister, D.L., Logan, T.J. (1978). Phosphate adsorption-desorption characteristics of soils and bottom sediments in the Maumee River basin of Ohio. *Journal of Environmental Quality*, *7*(1), 87-92.

McLennan, D., Barnes, H., Noble, M., Davies, J., Garratt, E. Dibben, C. 2011. The English Indices of Deprivation 2010. Department for Communities and Local Government.

Meador, M. R., Goldstein, R. M. (2003). Assessing water quality at large geographic scales: relations among land use, water physicochemistry, riparian condition, and fish community structure. *Environmental Management*, *31*(4), p504-517.

Meegan, R. (2003). Urban Regeneration, Politics and Social Cohesion: The Liverpool Case. Reinventing the City?: Liverpool in Comparative Perspective, p53-79.

Mermillod-Blondin, F., Creuzé des Châtelliers, M., Marmonier, P., & Dole-Olivier, M. J. (2000). Distribution of solutes, microbes and invertebrates in river sediments along a riffle-pool-riffle sequence. *Freshwater Biology*, 44(2), 255-269.

Merritt, S. (1997) Introduction to the Economics of Water Resources: an international perspective (London, UCL Press).

Mersey Basin Campaign. (2015). Retrieved 10th May 2015 from http://www.merseybasin.org.uk/.

Natural England. (2014). Retrieved from http://publications.naturalengland.org.uk/

Nolan, P.A. & Guthrie, N. (1998). River rehabilitation in an urban environment: examples from the Mersey Basin, North West England. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 8, 685–700

Office for National Statistics. (2013). Retrieved 10th May 2015 from http://www.ons.gov.uk/ons/rel/census/2011-census-analysis/170-years-of-industry/170-years-of-industrial-changeponent.html.

Parker, D. (2001). The Sum of Our Parts: Mixed-heritage Asian Americans. *Mixed Heritage Asian Americans, p185-196.*

Parkinson, M. (1989). The Thatcher Government's Urban Policy: a Review.

Puckett, L. J. (1995). Identifying the major sources of nutrient water pollution. *Environmental Science & Technology*, *29*(9), 408-414.

Raco, M. (2003). Remaking Place and Securitising Space: Urban Regeneration and the Strategies, Tactics and Practices of Policing in the UK. Urban Studies, 40(9), 1869-1887.

Ridgway, J., Shimmield, G. (2002). Estuaries as Repositories of Historical Contamination and their Impact on Shelf Seas. *Estuarine, Coastal and Shelf Science*, 55, 903–928.

Rodríguez, J.F. Garcia, M.H., Bombardelli, F.A., Guzmán, J.M., Rhoads, B.L., Herricks, D. (2000). Naturalisation of urban streams using in-channel structures. Joint Conference on Water Resources Engineering and Water Resources Planning and Management – ASCE July 30 - August 2, 2000, Hyatt Regency, Minneapolis, Minnesota.

Rousseau, M. (2009). Re-imaging the City Centre for the Middle Classes: Regeneration, Gentrification and Symbolic Policies in 'Loser Cities'. *International Journal of Urban and Regional Research*, 33(3), 770–788.

Shafik, N. (1994). Economic Development and Environmental Quality: An Econometric Analysis. *Oxford Economic Papers New Series: Special Issue on Environmental economics*, 46, 757-773.

Sharp, R., Maclean, N. (2010). Going fishing: recent trends in recreational angling. Silent Summer: The State of Wildlife in Britain and Ireland, 107, p110.

Sheail, J. (1988). River regulation in the United Kingdom: An historical perspective. *Regulated Rivers: Research & Management*, 2(3), 221–232.

Struthers, W.A.K. (1997). From Manchester Docks to Salford Quays: Ten Years of Environmental Improvements in the Mersey Basin Campaign. *Water and Environment Journal*, 11(1), 1-7.

Sukopp, H., Weiler, S. (1988). Biotope mapping and nature conservation strategies in urban areas of the Federal Republic of Germany. *Landscape and Urban Planning*, 15, 39–58.

Takano, T., Nakamura, K., Watanabe, M. (2002). Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces. Journal of Epidemiol Community Health. 56, 913-918.

Taylor, A.F., Wiley, A., Kuo, F.E., Sullivan, W.C. (1998). Growing Up in the Inner City: Green Spaces as Places to Grow. *Environment and Behaviour*, 30(1), 3-27.

The National Archives. (1974). Retrieved 10th of May from http://www.legislation.gov.uk/ukpga/1974/40.

UkCrimeStats.com. (February 2014 to January 2015). Retrieved 15th of March 2015 from http://www.ukcrimestats.com/Constituency/66066

United States Environmental Protection Agency. (2012). Retrieved 28th of March 2015 from http://water.epa.gov/type/rsl/monitoring/vms57.cfm

Waddington, D., King, M. (2009). Identifying common causes of UK and French riots occurring since the 1980s. *The Howard Journal of Criminal Justice*, 48(3), 245-256.

Wakida, F.T., Lerner, D.N. 2005. Non-agricultural sources of groundwater nitrate: a review and case study. *Water Research,* 39(1), 3–16

Webber, R., T. Butler. (2007). Classifying Pupils by Where They Live: How Well Does this Predict Variations in their GCSE Results? Urban Studies 44(7), 1229-53.

Wood, R. Handley, J. (1999). Urban Waterfront Regeneration in the Mersey Basin, North West England. *Journal of Environmental Planning and Management*, 42(4), 565-580.

Wood, R. Handley, J., Kidd, S. (1999). Sustainable Development and Institutional Design: The Example of the Mersey Basin Campaign. *Journal of Environmental Planning and Management*, 42(3), 341-354.

	Riverside	Princes Park	Liverpool Average	National Average
Household Income	£32,500	£24,300	£30,100	£36,400
Unemployment %	16.7	28	19.4	11.2
Crime Rate per 1000	246.1	98.9	91.9	66.4
Deprivation %	38.6	93.7	49.6	U/A
Education % 5+ A-C GCSEs	38	36.4	56.6	59.2
Population Change 2002-2012 (%)	38.3	23.2	5.8	7.3
HOUSE PRICE 2013 Flat	£126,738	£108,418	£113,182	£151,743
HOUSE PRICE 2013 Terraced	£100,133	£116,872	£92,216	£121,946
HOUSE PRICE 2013 Semi	£104,998	£187,784	£157,015	£99,400
HOUSE PRICE 2013 Detached	U/A	U/A	£245,001	£254,468
Percentage of Child Poverty	44.9	55.1	32.5	20.1
Percentage housing in Council Tax Band A	55.8	88.7	60.5	U/A
Percentage housing in Council Tax Band B	13.1	6.2	17.1	U/A
Percentage housing in Council Tax Band C+	30.9	3.7	22.2	U/A

Table 1: Selected data to be used to analyse links between variables such as household income and child poverty. Three wards were selected to compare to Liverpool Averages and National Average statistics Data supplied by Liverpool City Council (2013)

9. Appendices

Site Number	River	Site	Stretch length/km	Chemistry	Biology	Nitrates	Phosphates
1	Birket	The Fender To Great Culvert	2.2	F	E	2	5
2	Rivacre Brook	A41 To Fwl	5.3	C	E	3	5
3	Barrow Brook	Ashton Bk. To Gowy	2.1	B	B	6	4
4	Cliff Brook	Qsl At Grange Bk To Weaver	3.7	B	F	5	5
5	Alt	Stockbridge Lane To Liverpool North Stw	5.7	C	D	2	5
6	Alt	Hillhouse Stw To Alt Bridge	4.7	C	D	6	6
7	Douglas	Poolstock Brook To Crooke	4.5	B	C	2	3
8	Whittle Brook	Qsl At A570 To Union Bank Bk.	3.4	A	C	3	3
9	Mersey	Woolston New Cut To Fwl(Howley)	8	D	E	4	5
10	Bollin	Pedley (Birkin) Bk. To Msc	9.9	B	C	4	5
11	Pennington Brook (Glaze)	Leigh Stw To Glazebury Stw	3.4	D	E	4	5
12	Moss Brook	Astley Bk. To Glaze	2.2	C	E	5	6
13	Pennington Brook	Westleigh Bk. To Leigh Stw	2.7	C	C	3	5
14	Douglas	Pearl Bk To Poolstock Bk	15.5	B	C	3	4
15	Alt	M57 To Hillhouse Stw	7.5	D	F	6	6
16	Singing Clough Brook	Qsl At Worsley Road To Irwell	1.9	F	E	3	5
17	Bradshaw Brook	Bradshaw Brow To Tonge	5.2	A	B	1	2
18	Croal	Tonge/Bradshaw Bk. Confl. To Croal Minor	0.7	A	C	1	2
19	Douglas	Crooke To Douglas Valley Stw	10.5	B	C	2	3
20	Irk	Wince Brook To Moston Bk.	10.3	C	E	5	5
21	Irwell	Chest Wheel Bridge To Roch	10.3	A	C	2	4
22	Roch	Rochdale Stw To Irwell	15.2	C	E	2	5
23	Irk	Moston Bk. To Irwell	1.7	D	E	5	5
24	Ribble	Calder To Fwl	27.4	A	B	3	4
25	Weaver	Navigation Overflow To Weston Canal	15	E	F	4	5
26	Lostock	M6 To Leyland Stw	7.6	A	C	2	4
27	Davyfield Brook	Qsl At Hoddlesden Res To Roman Rd	3.3	A	A	1	2
28	Lostock	Leyland Stw To Yarrow	10.2	C	D	5	5
29	Douglas	Douglas Valley Stw To Fwl At Rufford	4.6	D	C	4	5
30	Douglas	Squirrel Bridge To Pearl Bk	1.6	A	D	1	2

Table 2: 2009 data for thirty Environment Agency field sites selected at random within the Mersey Catchment (Environment Agency, 2009)

Field Site Number	River	Site	Stretch length/km	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
1	Birket	The Fender To Great Culvert	2.2	F	F	F	E	E	E	E	E	E	E	E
2	Rivacre Brook	A41 To Fwl	5.3	C	C	C	D	E	E	D	D	D	C	C
3	Barrow Brook	Ashton Bk. To Gowy	2.1	B	B	C	C	B	B	C	C	C	C	C
4	Cliff Brook	Qsl At Grange Bk To Weaver	3.7	B	B	B	B	B	B	B	B	A	B	B
5	Alt	Stockbridge Lane To Liverpool North Stw	5.7	C	D	D	D	D	D	D	D	D	E	E
6	Alt	Hillhouse Stw To Alt Bridge	4.7	D	C	C	C	C	D	D	E	E	E	E
7	Douglas	Poolstock Brook To Crooke	4.5	B	B	B	B	B	B	B	C	C	C	B
8	Whittle Brook	Qsl At A570 To Union Bank Bk.	3.4	A	B	B	B	B	B	B	A	A	B	B
9	Mersey	Woolston New Cut To Fwl(Howley)	8	D	D	D	D	D	D	D	D	D	E	E
10	Bollin	Pedley (Birkin) Bk. To Msc	9.9	B	B	B	B	C	C	C	B	B	C	C
11	Pennington Brook (Glaze)	Leigh Stw To Glazebury Stw	3.4	D	C	C	D	E	E	E	E	E	E	E
12	Moss Brook	Astley Bk. To Glaze	2.2	C	C	C	C	E	E	E	E	E	E	E
13	Pennington Brook	Westleigh Bk. To Leigh Stw	2.7	C	C	C	C	C	C	C	C	C	D	D
14	Douglas	Pearl Bk To Poolstock Bk	15.5	B	B	B	B	B	B	B	B	B	B	B
15	Alt	M57 To Hillhouse Stw	7.5	D	E	E	D	D	D	D	D	E	E	E
16	Singing Clough Brook	Qsl At Worsley Road To Irwell	1.9	F	F	F	F	F	F	F	E	E	F	F
17	Bradshaw Brook	Bradshaw Brow To Tonge	5.2	A	A	A	A	A	A	A	A	A	B	B
18	Croal	Tonge/Bradshaw Bk. Confl. To Croal Minor	0.7	A	A	A	A	A	A	A	A	B	B	B
19	Douglas	Crooke To Douglas Valley Stw	10.5	B	B	B	B	B	B	B	B	B	B	B
20	Irk	Wince Brook To Moston Bk.	10.3	C	C	C	C	C	B	B	C	E	E	E
21	Irwell	Chest Wheel Bridge To Roch	10.3	A	A	A	A	A	A	B	B	A	A	A
22	Roch	Rochdale Stw To Irwell	15.2	C	B	B	B	B	B	C	B	B	B	B
23	Irk	Moston Bk. To Irwell	1.7	D	C	C	C	C	C	C	C	E	E	E
24	Ribble	Calder To Fwl	27.4	A	A	A	A	A	B	B	B	B	B	B
25	Weaver	Navigation Overflow To Weston Canal	15	E	E	E	E	E	E	E	E	E	E	E
26	Lostock	M6 To Leyland Stw	7.6	A	A	A	A	A	A	A	C	B	B	A
27	Davyfield Brook	Qsl At Hoddlesden Res To Roman Rd	3.3	A	A	A	B	B	B	B	B	B	B	B
28	Lostock	Leyland Stw To Yarrow	10.2	C	B	B	D	E	E	D	D	D	C	C
29	Douglas	Douglas Valley Stw To Fwl At Rufford	4.6	D	E	E	E	D	D	D	C	C	D	D
30	Douglas	Squirrel Bridge To Pearl Bk	1.6	A	A	A	A	A	A	B	C	C	B	A

Table 3: Chemistry Data for 30 randomly selected field sites within the Mersey Catchment over 11 years (data selected from the Environment Agency website)

Field Site Number	River	Site	Stretch length/km	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
1	Birket	The Fender To Great Culvert	2.2	E	E	E	E	D	D	D	D	U/A	D
2	Rivacre Brook	A41 To Fwl	5.3	E	E	E	E	E	U/A	E	E	U/A	E
3	Barrow Brook	Ashton Bk. To Gowy	2.1	B	B	B	C	C	C	C	C	U/A	C
4	Cliff Brook	Qsl At Grange Bk To Weaver	3.7	F	F	D	D	D	D	D	D	U/A	D
5	Alt	Stockbridge Lane To Liverpool North Stw	5.7	D	E	E	E	E	E	D	D	U/A	D
6	Alt	Hillhouse Stw To Alt Bridge	4.7	D	D	D	D	D	D	F	F	U/A	F
7	Douglas	Poolstock Brook To Crooke	4.5	C	C	C	C	C	C	D	D	U/A	D
8	Whittle Brook	Qsl At A570 To Union Bank Bk.	3.4	C	C	C	C	C	C	C	C	U/A	C
9	Mersey	Woolston New Cut To Fwl(Howley)	8	E	E	E	E	E	F	F	F	U/A	E
10	Bollin	Pedley (Birkin) Bk. To Msc	9.9	C	C	C	C	C	C	E	E	U/A	E
11	Pennington Brook (Glaze)	Leigh Stw To Glazebury Stw	3.4	E	E	E	E	E	E	E	E	U/A	E
12	Moss Brook	Astley Bk. To Glaze	2.2	E	E	E	E	E	E	E	E	U/A	E
13	Pennington Brook	Westleigh Bk. To Leigh Stw	2.7	C	C	E	E	E	E	C	C	U/A	C
14	Douglas	Pearl Bk To Poolstock Bk	15.5	C	C	C	D	D	D	D	D	U/A	D
15	Alt	M57 To Hillhouse Stw	7.5	F	F	F	E	E	E	E	E	U/A	E
16	Singing Clough Brook	Qsl At Worsley Road To Irwell	1.9	E	F	F	F	F	F	F	F	U/A	F
17	Bradshaw Brook	Bradshaw Brow To Tonge	5.2	B	B	B	C	C	B	B	B	U/A	D
18	Croal	Tonge/Bradshaw Bk. Confl. To Croal Minor	0.7	C	C	C	C	C	C	U/A	U/A	U/A	U/A
19	Douglas	Crooke To Douglas Valley Stw	10.5	C	C	C	C	C	C	D	D	U/A	D
20	Irk	Wince Brook To Moston Bk.	10.3	E	E	E	E	E	E	E	E	U/A	E
21	Irwell	Chest Wheel Bridge To Roch	10.3	C	D	D	D	D	D	E	E	U/A	E
22	Roch	Rochdale Stw To Irwell	15.2	E	E	D	D	D	C	C	C	U/A	D
23	Irk	Moston Bk. To Irwell	1.7	E	E	E	E	E	E	E	E	U/A	E
24	Ribble	Calder To Fwl	27.4	B	B	B	B	B	B	B	C	U/A	C
25	Weaver	Navigation Overflow To Weston Canal	15	F	F	F	F	F	F	F	F	U/A	F
26	Lostock	M6 To Leyland Stw	7.6	C	C	C	D	D	D	E	E	U/A	E
27	Davyfield Brook	Qsl At Hoddlesden Res To Roman Rd	3.3	A	A	B	B	B	A	A	A	U/A	B
28	Lostock	Leyland Stw To Yarrow	10.2	D	D	D	D	D	C	C	C	U/A	E
29	Douglas	Douglas Valley Stw To Fwl At Rufford	4.6	C	C	C	C	C	C	D	E	U/A	E
30	Douglas	Squirrel Bridge To Pearl Bk	1.6	D	D	D	D	D	D	D	D	U/A	D

Table 4: Biological Data for 30 randomly selected field sites within the Mersey Catchment for 10 years (data selected from the Environment Agency website)

Field Site Number	River	Site	Stretch length/km	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
1	Birket	The Fender To Great Culvert	2.2	2	2	2	2		2	2		2	3
2	Rivacre Brook	A41 To Fwl	5.3	3	3	3	3	3	3	3	3	3	3
3	Barrow Brook	Ashton Bk. To Gowy	2.1	6	6	6	6	5	5	6	6	6	6
4	Cliff Brook	Qsl At Grange Bk To Weaver	3.7	5	5	5	5	5	5	5	5	5	5
5	Alt	Stockbridge Lane To Liverpool North Stw	5.7	2	2	2	2	2	2	2	2	2	2
6	Alt	Hillhouse Stw To Alt Bridge	4.7	6	6	6	6	6	6	6	6	6	6
7	Douglas	Poolstock Brook To Crooke	4.5	2	3	3	3	3	3	3	3	3	3
8	Whittle Brook	Qsl At A570 To Union Bank Bk.	3.4	3	2	2	2	3	3	3	3	3	3
9	Mersey	Woolston New Cut To Fwl(Howley)	8	4	4	4	4	4	4	4	4	4	4
10	Bollin	Pedley (Birkin) Bk. To Msc	9.9	4	4	4	4	4	4	4	4	4	4
11	Pennington Brook (Glaze)	Leigh Stw To Glazebury Stw	3.4	4	4	4	4	4	4	4	4	4	4
12	Moss Brook	Astley Bk. To Glaze	2.2	5	5	5	5	5	4	4	4	4	4
13	Pennington Brook	Westleigh Bk. To Leigh Stw	2.7	3	3	3	3	3	3	3	3	3	3
14	Douglas	Pearl Bk To Poolstock Bk	15.5	3	3	3	3	3	3	3	3	3	3
15	Alt	M57 To Hillhouse Stw	7.5	6	6	6	6	6	6	6	6	6	6
16	Singing Clough Brook	Qsl At Worsley Road To Irwell	1.9	3	5	5	4	2	2	3	3	3	3
17	Bradshaw Brook	Bradshaw Brow To Tonge	5.2	1	1	2	2	1	1	1	1	1	2
18	Croal	Tonge/Bradshaw Bk. Confl. To Croal Minor	0.7	1	1	1	1	1	1	1	1	1	1
19	Douglas	Crooke To Douglas Valley Stw	10.5	2	3	3	3	3	3	3	3	3	3
20	Irk	Wince Brook To Moston Bk.	10.3	5	5	6	6	6	5	5	5	4	4
21	Irwell	Chest Wheel Bridge To Roch	10.3	2	3	3	3	3	3	3	3	3	3
22	Roch	Rochdale Stw To Irwell	15.2	2	2	2	2	2	2	2	2	2	2
23	Irk	Moston Bk. To Irwell	1.7	5	5	6	6	6	5	5	5	4	4
24	Ribble	Calder To Fwl	27.4	3	3	3	3	4	4	4	4	4	4
25	Weaver	Navigation Overflow To Weston Canal	15	4	4	4	4	4	4	4	4	5	5
26	Lostock	M6 To Leyland Stw	7.6	2	2	2	2	2	2	2	2	2	2
27	Davyfield Brook	Qsl At Hoddlesden Res To Roman Rd	3.3	1	1	1	1	1	1	1	1	1	1
28	Lostock	Leyland Stw To Yarrow	10.2	5	5	5	5	5	5	5	5	5	5
29	Douglas	Douglas Valley Stw To Fwl At Rufford	4.6	4	4	5	5	6	5	5	4	4	4
30	Douglas	Squirrel Bridge To Pearl Bk	1.6	1	1	1	1	1	1	1	1	1	1

Table 5: Nitrates Data for 30 randomly selected field sites within the Mersey Catchment for 10 years (data selected from the Environment Agency website)

Field Site Number	River	Site	Stretch length/km	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
1	Birket	The Fender To Great Culvert	2.2	5	5	5	5	5	5	5	5	5	5
2	Rivacre Brook	A41 To Fwl	5.3	5	5	5	5	5	5	5	5	5	5
3	Barrow Brook	Ashton Bk. To Gowy	2.1	4	4	4	5	5	5	5	5	5	5
4	Cliff Brook	Qsl At Grange Bk To Weaver	3.7	5	5	5	5	5	5	5	5	5	5
5	Alt	Stockbridge Lane To Liverpool North Stw	5.7	5	5	5	5	5	5	5	5	5	5
6	Alt	Hillhouse Stw To Alt Bridge	4.7	6	6	6	6	6	6	6	6	6	6
7	Douglas	Poolstock Brook To Crooke	4.5	3	3	3	4	4	4	3	4	4	4
8	Whittle Brook	Qsl At A570 To Union Bank Bk.	3.4	3	4	4	4	4	4	4	4	4	4
9	Mersey	Woolston New Cut To Fwl(Howley)	8	5	5	5	5	5	5	6	6	6	6
10	Bollin	Pedley (Birkin) Bk. To Msc	9.9	5	5	5	5	5	5	6	5	6	6
11	Pennington Brook (Glaze)	Leigh Stw To Glazebury Stw	3.4	5	5	5	5	5	5	6	5	6	6
12	Moss Brook	Astley Bk. To Glaze	2.2	6	6	6	6	6	6	6	6	6	6
13	Pennington Brook	Westleigh Bk. To Leigh Stw	2.7	5	5	5	5	5	5	5	5	5	5
14	Douglas	Pearl Bk To Poolstock Bk	15.5	4	4	4	4	4	4	4	4	4	5
15	Alt	M57 To Hillhouse Stw	7.5	6	6	6	6	6	6	6	6	6	6
16	Singing Clough Brook	Qsl At Worsley Road To Irwell	1.9	5	5	5	6	6	5	5	5	5	5
17	Bradshaw Brook	Bradshaw Brow To Tonge	5.2	2	2	2	2	3	3	2	2	2	3
18	Croal	Tonge/Bradshaw Bk. Confl. To Croal Minor	0.7	2	2	2	2	3	3	3	3	3	3
19	Douglas	Crooke To Douglas Valley Stw	10.5	3	3	3	3	4	3	3	3	4	4
20	Irk	Wince Brook To Moston Bk.	10.3	5	5	6	6	6	6	6	6	6	6
21	Irwell	Chest Wheel Bridge To Roch	10.3	4	4	4	5	5	5	5	5	5	5
22	Roch	Rochdale Stw To Irwell	15.2	5	5	5	5	5	5	5	5	5	5
23	Irk	Moston Bk. To Irwell	1.7	5	5	6	6	6	6	6	6	6	6
24	Ribble	Calder To Fwl	27.4	4	4	4	5	5	5	5	5	5	5
25	Weaver	Navigation Overflow To Weston Canal	15	5	5	5	5	5	5	5	5	5	5
26	Lostock	M6 To Leyland Stw	7.6	4	3	4	4	4	4	4	4	4	4
27	Davyfield Brook	Qsl At Hoddlesden Res To Roman Rd	3.3	2	2	2	2	3	3	3	3	4	4
28	Lostock	Leyland Stw To Yarrow	10.2	5	5	5	5	6	6	6	6	6	6
29	Douglas	Douglas Valley Stw To Fwl At Rufford	4.6	6	6	6	6	6	6	6	6	6	6
30	Douglas	Squirrel Bridge To Pearl Bk	1.6	2	2	2	2	3	3	4	3	3	2

Table 6: Phosphates Data for 30 randomly selected field sites within the Mersey Catchment for 10 years (data selected from the Environment Agency website)